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THE CHEMICAL EXAMINATION OF URINE.

JOSEPH WALDAUER, PH.G., M.D.

[Read before the Yazoo Delta Medical Association, at Greenville, Miss., October 17, 1894.]

It is not the aim of the following article to give anything new on this subject; but, knowing the lack of interest by the general medical practitioner in anything pertaining to chemistry, it has been my endeavor to so handle this subject that any physician can, with accuracy, determine the constituents of urine after applying the various re-agents. Hence, instead of giving all the tests for albumen, sugar, etc., as has been done by other writers, my method is to give the re-agents, their re-actions, and the interpretation of the same.

It is left to the intelligence of the physician making the examination to draw his conclusions as to the location of the pathological lesions and the organs involved.

Before undertaking to make an examination of urine, the following should be at hand:

One urinometer and tube, two small glass funnels, one doz. test tubes, assorted sizes; 2 oz. nitric acid, 2 oz. sulphuric acid, 2 oz. acetic acid, 2 oz. liq. potassa, 2 oz. aqua ammonia, 2 oz. sol. barium chloride, 2 oz. Fehling's solution, 2 oz. tr. guaiac (made from unoxidized resin), 2 oz. peroxide hydrogen (Marchand), 1 oz. subnitrate bismuth, 2 oz. sol. nitrate of silver, spirit lamp, blue and red litmus paper, filtering paper.

ODOR.

First note the odor of the urine. If it has a violet odor, administration of turpentine; sweet odor, *diabetes mellitus*, or *glycosuria;* fetid odor, *cystitis, scurvy*, or *decomposition*. Besides these, there are foods which give to the urine a characteristic odor, viz.: Asparagus, cauliflower, onions. Among the most prominent drugs which impart a characteristic odor are ether, cubebs, copaiba, sandalwood, valerian, etc. After making these observations you will note the

REACTION.

By applying the blue and red litmus papers, if it be acid the blue litmus will turn red; if alkaline the red will turn blue.

SPECIFIC GRAVITY.

The specific gravity is taken by filling the urinometer tube about two-thirds full of urine, and inserting the urinometer, and the specific gravity can be read from the scale. If the specific gravity of the urine be 1026 or over, and highly colored, it would indicate an increase of *urea*, or *uric acid;* if the urine be pale, *diabetes mellitus*. If the specific gravity be 1014 or under, and highly colored or normal in color, you may suspect certain forms of Bright's disease; but should the urine be pale, there is either an excess of *water* or *diabetes insipidus*.

HEAT.

Pour a small quantity of urine into a test tube and apply heat. If it throws down a deposit which clears up on the addition of a few drops of nitric acid, *phosphates;* if it does not clear up, *albumen*. If there is a deposit in the urine, and it clears up on the application of heat, *urates;* if it does not clear up, *uric acid* or *phosphates*.

NITRIC ACID.

Put a small quantity of urine in a test tube and add nitric acid, letting it trickle slowly down the side of the tube; if a precipitate forms quickly, *albumen;* but if the precipitate forms after a time, *uric acid* and *urea nitrate* in crystals. If the application of nitric acid causes decomposition with effervescence and heat, *cystine* and *urea;* without heat, *uric acid*.

SULPHURIC ACID.

Add to a small quantity of urine in a test tube a few drops of strong sulphuric acid; if the color changes to brown, *urohæmatin*. If sugar has been added, and the color turns to crimson or violet, it indicates the presence of *biliary acids*. If the color is violet without the addition of sugar, *indican* is present.

ACETIC ACID.

Add acetic acid to a small quantity of urine in a test tube, and if a precipitate is thrown down insoluble in an excess of acid, but soluble on the addition of nitric acid, *mucus* is present. If the addition of acetic acid causes a turbidity insoluble in nitric acid, but clears up on the application of heat, *urates*, and if it does not clear up, *albumen* is present.

LIQUOR POTASSÆ.

To a small quantity of urine in a test tube (and precipitate is present) add liquor potassæ, and it clears up, *urates* or *uric acid*. If the urine is clear and the addition of liquor potassæ forms a gelatinous mass, *pus;* if it turns brown on boiling, *sugar*, if chrysophanic acid has not been administered; should the urine turn red on the addition of this re-agent, *blood*, if santonine, senna or rhubarb have not been administered.

SOL. BARIUM CHLORIDE.

To a specimen of urine contained in a test tube add a small quantity of barium chloride solution, and if a precipitate occurs soluble in nitric acid, *phosphates* present; insoluble in nitric acid, *sulphates*.

SOL. NITRATE OF SILVER.

To a portion of urine in a test tube add a solution of nitrate of silver, and if a yellow precipitate occurs soluble in nitric acid and ammonia, *alkaline phosphates;* if a white precipitate occurs, insoluble in nitric acid but soluble in free ammonia *chlorides*.

FEHLING'S SOLUTION.

To one-half drachm Fehling's solution contained in a test tube add five drachms of urine, and boil, and if there is an amber-colored liquid with a yellow flocculent precipitate, *peptones* present; if the liquid is orange-colored, with an orange yellow precipitate, *glucose*.*

SUBNITRATE OF BISMUTH.

Subnitrate of bismuth added to urine that has been rendered strongly alkaline with liquor potassæ, and boiled, throws down a black precipitate, *glucose*.*

TR. GUAIAC AND PEROXIDE OF HYDROGEN.

To a small quantity of urine add tr. guaiac, and then add a few drops of peroxide of hydrogen (Marchand), and if the liquid turns a bluish green, *blood* is present.

In conclusion, I will say that, if this article will serve to stimulate the members of the profession to realize the importance of making these urinary analyses, and still further to make them more frequently than the majority of us are prone to do, thereby throwing the clear light of correct diagnosis on otherwise obscure cases, and follow it with appropriate therapeutic remedies with great benefit to their patients and satisfaction to themselves, I will feel amply repaid for all the pains and time bestowed upon it.

*It must be remembered before testing urine for sugar that if albumen is present it must be boiled and filtered to free it of the albumen. If this is neglected, the tests for sugar are of no value.

A TEXT-BOOK

OF

MATERIA MEDICA,

THERAPEUTICS, AND PHARMACOLOGY.

BY

GEORGE FRANK BUTLER, PH.G., M.D.,

Professor of Materia Medica and Clinical Medicine in the College of Physicians and Surgeons, Medical Department of the University of Illinois; Professor of General Medicine and Diseases of the Digestive System, Chicago Clinical School; Attending Physician to Cook County Hospital; Member of the American Medical Association, Illinois State Medical Society, Chicago Medical Society, Chicago Pathological Society, and Chicago Society of Internal Medicine; Fellow of the Chicago Academy of Medicine, etc.

THIRD EDITION, THOROUGHLY REVISED.

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TO

THE MEDICAL STUDENTS OF THE UNITED STATES,

IN THE HOPE THAT IT MAY AID THEM IN ATTAINING A CORRECT
KNOWLEDGE OF THE NATURE AND ACTION OF DRUGS
AND THE RATIONAL TREATMENT OF DISEASE,

THIS WORK IS CORDIALLY INSCRIBED BY

THE AUTHOR.

PREFACE TO THE THIRD EDITION.

THAT the present text-book has passed to the third edition in the space of three years awakens the liveliest satisfaction in the mind of the author, since it proves that the hopes he entertained regarding the usefulness of the work were not wholly unfounded. The kind and generous acceptance of the result of his labors by the medical press in general, together with congratulatory correspondence from various parts of the country, further attest the value of the method and treatment adopted, so far as they offer a practical and efficient aid to instruction. Encouraged by such testimonials of approval, the author has devoted especial care to a revision of the last edition, in order that nothing should be omitted that would add to the completeness of the text, and that the student might be benefited by the latest knowledge touching the topics considered. Important changes have been made where necessary, a fuller treatment of certain subjects has been adopted, and unimportant details have been excluded in favor of new and more useful information. Should the present thorough revision of the work meet with the marked favor accorded the earlier editions, the author's earnest wishes will be fulfilled.

G. F. B.

PREFACE.

THE present work has been undertaken with the immediate object of supplying the student of medicine with a clear, concise, and practical text-book, adapted for permanent reference no less than for the requirements of the class-room.

The arrangement—embodying the synthetic classification of drugs based upon therapeutic affinities—the author believes to be at once the most philosophical and rational, as well as that best calculated to engage the interest of those to whom the academic study of the subject is wont to offer no little perplexity.

Should an intelligent and comprehensive understanding of Materia Medica and Therapeutics be facilitated by the author's treatment of the theme, the deductions derived from his experience as a practitioner and instructor will not have been committed to print in vain.

Special attention has been given to the Pharmaceutical section, which there is reason to hope will be found exceptionally lucid and complete. It has been deemed advisable, however, in the general work to include in the descriptive enumeration only such drugs as experience has proved to be of unquestionable value and are of standard and authoritative acceptance in general practice. In accordance with this plan, many new and comparatively untried remedies have been omitted, since, while of established efficacy in certain conditions, they are as yet too imperfectly known to warrant association with remedial agents bearing the sanction of exhaustive scrutiny. So, too, a few official drugs have been excluded because they are practically never used or are employed only in isolated instances.

It will be observed that "*Untoward Action*" and "*Poisoning*"

are treated under separate heads. By the former it is intended to record the effects of *medicinal doses* in developing certain symptoms dependent more or less upon individual susceptibility, not necessarily assuming the aggravated form incident to toxic doses, which exert a definite influence regardless of idiosyncrasy.

In giving the careful Latin accent and quantity of medicinal nomenclature (Foster), so far as practicable with the prosodial signs employed, the design has been to correct a prevalent disregard of proper pronunciation reflecting little credit upon those to whom a knowledge of the subject should be as exact as it is familiar. To the prescription-writer the appropriate Latin genitive, and in a few cases the accusative, will doubtless afford valuable assistance.

During the preparation of the work many important text-books, periodicals, etc. have been freely consulted, and from the U. S. Pharmacopœia chiefly, and from the National Dispensatory, have been adopted almost *verbatim* the "*Origin*" and "*Description and Properties*" of the various drugs under consideration.

In reviewing the progress of the present volume the author desires to express his cordial acknowledgments to Prof. Carl S. N. Hallberg, Ph. G., whose exhaustive contribution of "WEIGHTS AND MEASURES" and "PHARMACEUTICAL PREPARATIONS" cannot fail to lend permanent interest to the work; to Dr. Alfred C. Cotton, Dr. Wm. E. Quine, and Dr. James B. Herrick, for friendly suggestions; to Dr. D. Lee Shaw, Dr. Fred C. Zapffe, and Dr. Thomas J. Jackson, for assistance in compilation. To Mr. Storrow Higginson the author's personal thanks are due for his scholarly assistance in the revision of the text.

G. F. B.

CHICAGO, ILL., 794 WEST ADAMS ST.,
September, 1896.

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A TEXT-BOOK

OF

MATERIA MEDICA,

THERAPEUTICS, AND PHARMACOLOGY.

INTRODUCTION.

THE history of medicine since the time of Hippocrates is the record of a more or less continuous series of experimental researches, having for their paramount object a precise and comprehensive knowledge of the nature of disease and the practical application of remedial science. Regarded *sensu latiori*, the various "schools" which have arisen from time to time are philosophically co-ordinate, their fundamental principles being referable to one dominating thought—the art of healing.

It is scarcely practicable here, even were it necessary, to review in detail the separate doctrines which have obtained during the evolution of sectarian therapy. From the earliest ideas promulgated by the ancient priests of Æsculapius, through the subsequent era of Hippocrates, Theophrastus, and the Alexandrian school, influenced by the crude, misguided notions prevailing ere science emerged from its infancy; discernible in the Galenic and other tentative yet memorable systems, in the epoch of Paracelsus and the Monastic Medicine of the Mediæval period, and in the radical theories of Rasori and Roeschlaub which attended the development of the last, and have left a passing impress upon the present, century,—through all, the gradual acceptance of empiricism as a legitimate guide to therapeutic truth is manifest. Yet viewed with reference to their underlying animus, these varied expressions of scientific endeavor distinguishing the past are perceptibly linked with the ampler system which has emanated from the more rational methods of modern research.

The light of inductive reasoning and the marvellous progress in scientific knowledge which characterize the nineteenth century are a living appeal from the idealism of a less enlightened age. The release from tradition—anticipated in the labors of Bichat and others—to which later investigation owes so many signal triumphs has doubtless been profoundly affected by the realistic tendency of modern thought. It is to the startling advancement attained in the natural sciences, however, resulting in a chemical skill and in mechanical appliances of incomparable value, that we must look for the originating impulse which has inspired the therapeutic knowledge of the present day. It needs but little reflection to perceive the immeasurable superiority of actual acquirements over the vague, hesitating—though ardent and laborious—methods to which the theory and practice of medicine were so long subservient.

We have said that, considered in the larger sense, the history of medicine has been a harmonious rather than an intermittent development. It is not to be supposed that, in the evolution of so momentous a scheme as the formulation of a remedial system applicable to the extensive catalogue of human ailments, there should not have occurred spasmodic and ill-adjusted theories, crystallizing in many a strange *cultus*, which, if ineffectual in retarding the onward sweep of rational progress, has, it may be safely averred, worked incalculable injury to the cause of medical truth. Mesmerism, astrology, spiritualism, even theosophy, however incongruously conjoined, and similar vagaries have not failed to enlist among their votaries many enraptured, even noted, believers; nor is the mental strabismus with which they are afflicted amenable to any resource of rational treatment. We need, moreover, but contemplate the pitiable hallucinations which urge the pious pilgrimages to Marpingen, Lourdes, and Trèves, and the criminal negligence and incredible offence to reason which stultify the so-called "Christian Scientists" (as ironical a misnomer as language permits), to realize that miraculous cures still hold blighting yet potent sway over the minds of the ignorant and credulous. May not even the assumption of thaumaturgical powers be one day possible with those who arrogate to themselves a knowledge little short of omniscience, and to whose rudimentary intelligence the laws of nature convey no perceptible lesson? As from the sublime to the ridiculous, so from faith to fanaticism, it is but a step, after all.

It is appropriate here to emphasize the unfailing—nay, ever-

increasing—importance of therapeutics in its relation to the welfare of mankind. Especially imperative is this obligation in an epoch of unprecedented achievement in every department of science which contributes to the perfection of the healing art, in which general advancement medicine has borne no inconspicuous a rôle.

The rapid advance of experimental science, however, applied to medical treatment, culminating in bacteriological discoveries of signal value to mankind, and the remarkable triumphs attending the development of operative surgery, have inevitably tended to disparage the equally noble and far more widely cultivated field of therapeutic science. This result is the more deplorable since it creates in the minds of the young and inexperienced an impression of contrast and divergence in departments of study naturally and indissolubly correlated. It is scarcely surprising that the marvels of the laboratory and the splendid achievements of the arena should possess for the tyro an entrancing interest. Yet it is to be borne in mind that the most brilliant triumphs of diagnostic and surgical skill might prove futile as the means of arresting disease were they not supplemented by the *course of treatment* which constitutes *therapy.*

It must be confessed that medical art has too often been discredited by professional incompetence, and consequent failure to effect the *cure* that with the laity is wont to form, however ignorantly, the only criterion of ability. In America especially—where from defective laws the widest latitude is given to incapacity and imposture—the lack of proper academical training is frequently the cause of serious consequences in practice, little calculated to enhance the popular confidence and esteem. It therefore behooves the student of medicine to master thoroughly the details of the remedial art, become practically conversant with physiological conditions and the manifold phenomena of morbid anatomy, and so familiarize himself with the varying indications of disease that in the presence of whatever malady, his diagnosis and treatment may command respect—not only from the laity, but, what is of far more consequence to him, from the profession.

It is almost superfluous to lay stress upon pharmaceutical knowledge as a powerful weapon in the armament of the medical practitioner. Yet no branch of therapeutic science has, perhaps, been more neglected than a practical acquaintance with the nature and uses of Materia Medica, their origin, potency, and characteristic value, as well as their physiological action, and the incompatible

and synergistic agents upon which their efficacy often largely depends.

Thanks to careful and competent training among pharmacists, the skilful preparation and dispensing of drugs relieve the physician of much responsibility; yet he should be keenly sensible of the fact that the larger share of public confidence is reposed in him, and by diligent study of the subject endeavor to command the minutiæ of pharmacology, holding himself morally accountable for errors quite possible in the druggist's dispensary. It may not be irrelevant to add that in all medical procedure a sympathetic yet perfectly controlled nature, ready tact, and sterling common sense are cardinal requisites to professional triumph, it being generally true, as was long since observed by Hufeland, that "successful treatment requires only one-third science and two-thirds *savoir faire*."

Finally, the author would counsel the utmost seriousness in the pursuit of a calling which might aptly be termed "Christian Science"—the power to alleviate human suffering by means of curative agents with which the laboratory of nature has been mercifully stored. There can be no loftier, more practical manifestation of love to men than is exemplified in the benignant effort to assuage the ills to which mortality is heir; nor can any devotion be more privileged and inspiring than that which softens the shock of disease, illumines the darkness of mental and physical distress, and from the débris of misfortune, vice, and heredity creates anew the image of divine perfection. It is this uplifting, consecrated zeal, akin to veneration for medical science, which has endeared to the world the masters of the profession—of which the same wise Hufeland said: "To him who fails to make a religion of the healing art it is the most cheerless, wearisome, and thankless labor upon earth; indeed, in him it must become the greatest frivolity and a sin." And for those—and they are many—to whom the material, possibly mercenary, aspect of their task appeals unduly it is enough to cite in rebuke the elevated maxim of Stigelius:

Non omnia quae suscipimus lucrum spectant.

[*Thunbergii Dissertationes.*]

PHARMACOLOGY AND GENERAL THERAPEUTICS.

Remedies.—In a comprehensive sense every means of counteracting, curing, or mitigating disease or bodily disorder may be termed a remedy or remedial agent. The mode of treatment may be preventive, reparative, or restorative; but the agents employed by the physician are properly called *remedies*. Although their number is wellnigh as great as the multifarious causes of disease, the chief classes of remedies are comparatively few, and may be grouped mainly under the following heads:

Prophylactic, whereby attention is directed to the immediate environment of the patient, with a view to secure proper sanitation and outward conditions more favorable to recovery suggested by hygienic laws.

Sanitary, when hygienic treatment is combined, as it now usually is, with medical remedies, constituting what is known as *regimen*, including proper ventilation, temperature, diet, bathing, and exercise.

Imponderable, as when the forces of light, heat, cold, and electricity or magnetism are brought into requisition by the aid of science.

Mechanical, pertaining to certain surgical methods and remedial applications, or a course of physical training, including the peculiar yet often efficacious treatment known as *massage*.

Pharmaceutical, including a very large and varied class of remedies which, from their established curative properties and their signal importance to the physician (mĕdicus), are technically termed *medicines*. They are designed to preserve or restore the health of the animal organism, promote recovery in cases of injury or disease, and, in short, perform every office proper to a palliative or remedial agent.

Physiology is the study of the functions of the different organs of the animal body under normal conditions.

Pharmacology is, strictly speaking, the study of the functions

of the different organs of the animal body rendered abnormal by drugs.

Materia Medica deals especially with the sources from which drugs are derived, their chemical and physical properties, their constituent elements, and their general function as substances or agencies in the practice of medicine.

Pharmacy is restricted to the analysis and determination of drugs, and the science of preparing and dispensing medicines in the forms in which they are best administered.

Pathology is the study of the animal body rendered abnormal by disease.

Therapeutics (from the Greek word meaning to *attend*, to *serve*) is the study of the diseased body under the influence of remedial agents and the science and practice of selecting and applying remedies for sickness and disease, and necessarily includes the proper care and treatment of invalids. "The ultimate aim of all medical research," it has been truly said, "is the treatment and prevention of disease." This constitutes the primary object of the therapeutist.

In its amplest signification therapeutics embraces all that relates to the science and art of *healing*, and the application not only of medicines, but of every remedial agent likely to accomplish this paramount motive of the physician's labor. Under the general term of therapeutics, therefore, are included the action of natural forces, the varied resources of Materia Medica, and the contingent considerations of climate, food, clothing, etc., grouped under two principal divisions:

Natural Therapeutics, being, as the term implies, a curative method dependent upon the laws of nature rather than the subsidiary arts of man.

Applied Therapeutics, including the scientific application of palliative or remedial agents having no counterpart in the living organism, designed, through the art of medicinal administration, to assist nature in the process of restoring health. This division constitutes more properly the study of therapeutics and the domain of professional practice.

Empirical Therapeutics implies the application of remedies to which experience has ascribed certain specific properties irrespective of systematic value. It is not based upon experimental research, but rather upon formulæ established by the accumulation of isolated facts—empiricism—and practical observation, apart

from theoretical reasoning and the relations of physiological phenomena as revealed by modern methods of investigation. Were it possible to extend indefinitely the list of remedial agents so as to embrace the entire field of therapeutic knowledge, the empirical method might attain the dignity of an exact science. Such, however, is the complexity arising from the manifold, often contradictory, impressions drawn from human experience that for the evolution of a systematic scheme of therapeutics the empirical system must of necessity prove inadequate.

Rational Therapeutics is based upon the use of medicines in accordance with a scientific knowledge of pathology and the physiological effects of remedial agents. Here nothing is left to chance, and the *nostrums* of the older system have but little weight compared with the methods of careful and intelligent diagnosis and a skilful administration of remedies suggested by well-known and accepted indications of disease. Every department of medical science has been illumined by the light of modern research, and the chemical and physical properties of Materia Medica submitted to severe and competent analysis, that Rational Therapeutics may establish a system through which the errors and uncertainty of empiricism may be supplanted by a more stable and philosophical method, and the chances of inaccuracy minimized. Through the college curriculum and the medium of professional intercourse, afforded by personal comparison of opinions and by innumerable publications throughout the world, the results of scientific experimentation are becoming widely diffused and the scope of serious investigation constantly enlarged.

In connection with this subject it may be well to call the attention of the student to the technical signification of the following terms:

Pharmacopœia (*pharmakon*, drug; *poicin*, to make), a book compiled by the government, or, as in the United States, a National Committee on Revision, and published by authority, establishing standards for the identification, purity, strength, and quality, and giving directions for the purification, valuation, preparation, compounding, and preservation of drugs, chemicals, and medicinal substances. The United States Pharmacopœia is revised decennially, the present (11th) edition having been adopted Jan. 1, 1894.

Official—Officinal.—Unnecessary confusion prevails concerning the precise import of these terms. They are readily understood by reference to the Latin originals from which they are derived.

Official drugs are those which bear the stamp of professional—*i. e. official*—sanction (Lat. *officium*, authority). They are practically ordered by the Pharmacopœia to be kept in all druggists' shops, the formulæ being supplied by the work revised in decennial conventions.

Officinal drugs are those prepared or kept by the druggist upon his own responsibility, bearing only the authority of the *shop* (Lat. *officina*, a shop). Such preparations are often included in works on Materia Medica, and, together with those emanating from other individual formulæ, are marked "unofficial."

The term "unofficinal," it will be seen, is a solecism; and it follows, moreover, that there are many preparations which are in pharmacy *officinal*, but not *official*, and that a pharmacopœial formula cannot possibly be *officinal*, although, speaking generally, all *official* drugs are *officinal* in that they are kept or prepared in the druggist's *shop*.

Dispensatory.—This is a compilation of and commentary on one or more pharmacopœias, enlarging the authoritative but restricted pharmacopœial formulæ by including the medical and physical history of the various substances, with directions regarding dosage, together with observations on their physiological action and therapeutics. It also contains information concerning drugs not accepted by pharmacopœial authority, yet which are of occasional use or interest. The Dispensatory is in effect a private publication and *unofficial*, in this respect differing essentially from a pharmacopœia. There are in the United States various works of this character, the United States and National Dispensatories being commonly in use.

CLASSIFICATION OF MEDICINES.

THE classification of drugs and remedial agents is a theme regarding which the many writers upon and teachers of medicine have shown a wider diversity of opinion, perhaps, than upon the physiological action and medical uses of individual remedies. The fact that therapeutics is far from being an exact science, and the rapid advance in our knowledge of normal physiological processes, of pathological conditions, and the systematic action of drugs, are sufficient explanation of the ever-changing judgments of our best observers concerning the action of certain medicinal agents under given conditions.

It follows that from time to time, as appears in reviewing the literature of the subject, different writers, in their attempt to keep pace with the advancement of knowledge, have devised various systems of classification.

In earlier days, when the therapeutist culled from the fields his simples for the cure of disease, there was naturally created a strong tendency toward a botanical classification. So far was the system pushed that in certain so-called schools of medicine the authority of Scripture was invoked, it being proclaimed as an axiom that "the leaves of the tree were for the healing of the nations" (Rev. xxii. 2). This eclecticism, strange as it may seem to-day, was the outgrowth of the Thompsonian or Botanical system of therapeutics. On the other hand, as an evolution of the old alchemic school, an attempt was made to found a classification by explaining the remedial action of all medicines upon a purely chemical basis.

With the advent of more modern methods of study, applied to the physiological action of drugs upon the animal economy, came the physiological classification, in which the effects of remedial agents were explained upon rational grounds.

It is hardly necessary to state that coexistent with these various endeavors to attain a philosophical method of classification, complicating them and perplexing their votaries, the dominating principle of empiricism held universal sway, setting at defiance in many instances the cardinal maxims of rational therapeutics, the rational therapeutist even to-day welcoming as a last resort the cruder, though often efficient, empirical method.

Some authors, perceiving the inutility of the older systems, have contented themselves with a mere alphabetical arrangement of medicinal agents, regardless of their origin, natural affinities, mode of preparation, and physiological action.

With due respect for the many able and worthy efforts at classification recorded in the history of modern therapeutics, the author believes that the main object of classifying medicinal remedies—viz. to facilitate the retention of a vast number of valuable yet isolated facts—is best accomplished by grouping them along the lines of greatest practical utility.

Remembering that the medical student of to-day is animated by an earnest effort to fit himself for the noblest sphere of usefulness —knowledge applied to the relief of human suffering—the author holds that the most philosophical, as well as practical, synthesis and comparison of remedial agents, based upon manifest physical

and physiological relationships, will afford to the pupil the widest grasp, from a therapeutical standpoint.

With the object of aiding the student, in accordance with this conviction the author has endeavored in this work to give emphasis to a therapeutical classification, claiming for it no especial originality,[1] but assured that the method he has selected is alike the most judicious and the one best calculated to respond to the demands of daily, practical utility.

The thoughtful and logical student of medicine must realize that there are two great classes of remedial agents:

1. Those used in cases which cannot be relieved by a single dose of any remedy, but require repeated and prolonged administration. 2. Those employed in cases which are susceptible of immediate relief by the exhibition of a single dose.

The remedies employed for the cure of the first class of cases have been appropriately styled *Disease-* or *Organic-Medicines*—an unscientific term, perhaps, yet useful to convey the intended idea, since they remove the *cause* of the departure from normal physiological action in the living organism—*i. e.* perversion of functional integrity, or morbid conditions.

Upon reflection it will be seen that remedial agents in the second class are, by the nature of the case, designed for the relief of some manifestation or change in the system or in its functions indicating the character, locality, severity, etc. of a morbid process—a symptom of disease. The remedies in this class, therefore, are termed *Symptom-* or *Functional-Medicines*, partly because of their specific virtue in relieving symptoms, partly from the fact that they produce certain manifestations characteristic of themselves.

Disease-Medicines are usually administered for the relief or cure of chronic diseases. *Symptom-Medicines* are employed to relieve symptoms of, or prevent complications in, acute diseases—not for the cure of the disease itself.

The classes named might be subdivided *ad infinitum*, yet it has seemed advisable to the author, for the sake of simplicity, to divide only the first class, *Disease-Medicines*, including the remedial agents employed therein, under three general heads, *Restoratives*, *Alteratives*, and *Antiseptics*.

It is obvious to every reflecting physician that a class of remedies act as such by supplying some deficiency in the animal organism, the agent in such cases being either itself the substance

[1] This classification is adapted from one formerly used by Prof. William H. Thomson of New York.

lacking, or its analogue, or by its presence restoring the deficient element or secretion. Iron or fats, for instance, act in certain forms of anemia in which these ingredients are wanting in the red blood-corpuscles; phosphorus or the earthy salts behave similarly in conditions where the tissues are deficient in these necessary constituents; and bitters, though not natural ingredients of the system, act upon the gastro-intestinal mucous membrane, stimulating the glands to secrete a larger quantity of normal digestive fluid.

In view of the physiological action of the remedies pertaining to this division, the term *Restoratives* so aptly expresses their general character that no apology is needed for its adoption.

The second division, *Alteratives*, can be administered without injurious results only in *diseased* conditions, in which the particular remedy combats in a specific and occult manner the prime etiological factor of the pathological derangement. These medicines act properly only upon diseased organisms, their peculiar effect never being obtained by the exhibition of a single dose, but only after prolonged administration. They are unnatural to the system, and are more or less poisonous. Functional medicines are also unnatural to the system, but they are given only to relieve symptoms of disease, not for the disease itself; whereas Alteratives relieve the symptoms by removing the cause of the disease. The latter normally produce no symptoms, the patient being unaware of their action save by a recognition of his gradually improved condition. Should, in fact, symptoms occur, they should serve as a warning that the remedy is not indicated or that the dose is unsuitable.

To elucidate this principle, the use of morphine to allay the pain of gout may be cited. A single dose is usually sufficient, yet it is not curative; while colchicum acts as an alterative through its well-known specific and eliminative properties, and by continued treatment cures the disease. Again, caffeine may be employed to relieve anemic neuralgia, yet it may require hemic restoratives to alleviate the morbid condition producing the symptoms.

A genuine alterative seems to have the property of antagonizing some disease. For instance, A and B are put under a prolonged course of mercury: A is salivated beyond recognition, while B's health improves—simply for the reason that B had syphilis, which A had not. At present the number of remedies which we are compelled to relegate to this class, Alteratives, for want of accurate knowledge regarding their *modus operandi*, is quite limited.

The second great class of agents to which the name *Symptom-*

Medicines is applied embraces all medicinal substances which, being introduced into the system, may produce by a single dose abrupt or serious disturbances of function. From the earliest history of medicine they have offered a tempting field to the therapeutist, because of the absolute certainty of their action in allaying symptoms or producing manifestations peculiar to themselves. It is perhaps superfluous to add that, owing to their extreme activity, the greater number of therapeutic errors may be ascribed to their use.

To the young practitioner the charm of therapeutics lies in that class of agents which produce immediate and tangible results. These are obtained most readily by the remedies affording instant relief of prominent symptoms of disease, such as pain, pyrexia, insomnia, etc. Yet the author is here constrained to add a word of caution to the amateur therapeutist, reminding him that, in the maturer knowledge derived from subsequent experience, he will have less to regret should he confine his study and practice to physiological medication—that is, to the examination and administration of legitimate restoratives and alteratives—rather than yield to the allurements presented by the energetic action of a large number of agents classed among Symptom-Medicines.

The members of this class of remedies have been variously divided and subdivided by different writers on therapeutics.

Antiseptics are classed among Disease-Medicines on account of their property of restoring to their normal condition the tissues, fluids, and secretions of the body by destroying the germs or micro-organisms which by their presence excite pathological processes.

This great class, Antiseptics, embraces some of our most important neurotics. Most of them are antipyretic, and many of them possess analgesic and hypnotic properties. Instance, chloral, a powerful antiseptic, hypnotic, antipyretic, and circulatory depressant. Considered only as an antiseptic, it would be classed as a Disease-Medicine; clinically, however, it is used more as a hypnotic, and therefore in this work it is ranked as a Symptom-Medicine—a neurotic in the subdivision of Hypnotics.

Drugs, in fact, exhibit so many different actions that an arbitrary line of demarcation between them is practically impossible, the author merely desiring to assign a given remedy to the class to which its chief therapeutic uses would naturally attribute it.

The principal use of opium, as we know, is to relieve pain. It

is the typical narcotic, yet it possesses astringent and hypnotic properties, and could therefore not inaptly be classed as an astringent or hypnotic.

It is already a question whether antipyrine should not be ranked in the division of Analgesics rather than Antipyretics, since, while formerly it was used almost exclusively for the reduction of temperature, we now know it to possess marked anodyne properties; so that it is actually doubtful which is its more important use—to lower temperature or to relieve pain.

These few illustrations serve to show how varied are the actions of drugs, and how their several divisions overlap one another. Thus, the last division of Disease-Medicines, Antiseptics, immediately precedes the first group of Symptom-Medicines, Antispasmodics, so closely are they allied, the last-named class possessing properties similar to those of that interesting division of Antiseptics—the Aromatics.

The next group, Antipyretics, is logically followed by Anesthetics, and this in turn by Hypnotics, Narcotics, etc., each group being succeeded by the one most closely resembling it in physiological and therapeutic action. The last group comprises the Astringents, classed under Symptom-Medicines, these agents occupying the borderland between external and internal medicines.

Caustics, the first group under topical remedies, naturally follow Astringents, since they differ from the latter drugs only in degree perhaps, as is well shown in sulphuric acid, which when diluted is an astringent, but undiluted an active caustic.

A thoughtful study of drugs as classified in this work will, it is hoped, enable the student to become more familiar with the comparative value of the various remedial agents than were possible had the author chosen an alphabetical arrangement, associating remedies having no possible relationship either in their actions or their medical uses.

ADMINISTRATION OF MEDICINES.

External Method of Application.—In order to utilize the absorptive power of the cutaneous surface for therapeutic purposes various methods have been adopted. The simplest of these, though by no means the most successful, is by

Inunction, which consists in an outward application of the medicinal agent, without abrasion of the cutis, and compulsory absorption through the process of "rubbing in." The horny

epidermis, however, presents an effectual barrier to the absorption of many drugs, and the

Endermic Method has been found more active. This plan consists in producing, by means of a blister, a raw surface, which readily absorbs the medicinal agent—morphine, strychnine, atropine, quinine, etc.—with highly marked effect. The process is somewhat painful and necessarily slow in action, being now almost wholly superseded by the

Hypodermic Method.—This consists in injecting the drug into the subcutaneous tissues by means of the hypodermic needle and syringe. Since absorption by the tissues takes place readily, it will be seen that this method of application is far more efficacious than those previously mentioned. Not all drugs, it is to be observed, are available for administration by the hypodermic process of injection. The eminent success attending the operation, however, renders it of signal value to the physician.

Parenchymatous Method.—This is a more heroic means of injection, by which the drug is deposited in the corporeal tissues. It is said to afford temporary relief in sciatica, but for various reasons is highly objectionable, chiefly because of the excruciating pain consequent to the operation.

Intravenous Injection may be resorted to in desperate cases: its dangers are obvious, however, and, save for the purpose of transfusion after severe hemorrhage, it can seldom be attempted with impunity.

Internal Administration.—The most obvious, and by far the most useful, method of internal administration is by the *mouth;* yet care and discretion are to be used even in so ordinary a process, and the physician should consider thoughtfully the time, consequent effects, and chemical changes, that the drug may produce the most beneficial results.

Inhalation is in many respects of the first importance as a method of internal administration. Its great facility in practice and its unquestionable efficiency—as in the case of anesthetics—render it readily available and highly beneficial, although the method has attained as yet only a limited use in therapeutics beyond a resort to it in pulmonary diseases.

Enemata.—A different class of administrative operations consists in injections into the rectum, which injections may be purgative, anodyne, nutrient, emollient, astringent, anthelmintic, etc. For speedy and efficient cleansing of the large intestine the purgative enema is of incomparable value, care being taken that the quantity

of the injection be sufficient, that it be passed up as far as possible, and that it remain as long as the patient is able to retain it.

Absorbable enemata are usually small in quantity; they have proved useful in certain cases of diarrhea and dysentery, and are serviceable when the act of swallowing is precluded by affections of the esophagus or in cases where the stomach requires complete rest. The rectum, however, possessing no digestive capacity, the injection should consist of the simplest materials and contain pepsin and acid or pancreatic fluid.

Another mode of securing beneficial results from internal administration through the absorptive properties of the intestine is by means of suppositories, readily introduced within the sphincter ani and dissolving at the temperature of the body.

To take the place of intravenous injection, normal solution, 0.6 of 1 per cent., is used as an enema in all conditions where the former is indicated, especially after major operations. From 7 to 17 fluidounces (207–503 Cc.) are injected, according to the individual tolerance of the patient. These injections are to be repeated, in the endeavor to secure the absorption of from 2 to 6 quarts (liters) of the solution in the course of twenty-four hours.

Dosage.—The term *dose* implies the quantity of a medicinal agent which under certain conditions it is advisable to administer, many considerations entering into the question, to be weighed by the features of the individual case. Dosage may be regarded as perhaps the most vulnerable point in therapeutic science, yet one upon which the art of healing almost wholly depends.

Since Heller in 1755 enunciated his philosophical maxims touching the rational method of testing the therapeutic effects of drugs, eminent clinicians have sought to solve the mysteries attending the action of various remedies whose *modus operandi* remains to this day obscure. Indeed, so great is the diversity of operation pertaining to the commonest remedies, conditioned by the character and circumstances of the case, as well as the amount and quality of the drug, that it is next to impossible to predicate the precise effects of agents whose physiological properties are theoretically and even practically established. The ordinary adult dose of opium, for instance, is 1 gr. (0.06 Gm.); yet in certain diseases, such as peritonitis, ten times that amount may be required to relieve the pain. The doses given in many text-books differ materially from those prescribed in actual practice, being intended to express only the average quantities to be administered, the exact amounts varying with the conditions of the

particular case. These conditions may be classed under the heads of age, sex, temperament, idiosyncrasy, habit, state of the system, temperature of the body, time of administration, intervals between doses, cumulative action of the drug, and the contingent considerations of diet, climate, race, etc.—oftentimes a complicated problem even to the most skilful therapeutist. A few suggestions regarding the leading characteristics of dosage, as limited by these various circumstances, may be of value to the student.

The influence exercised by *Age* is indubitable, as a rule the young requiring smaller doses than adults, the aged being least susceptible to therapeutic impressions. With regard to children several mathematical formulæ have been devised, none of which, however, has proved infallible—least of all those based upon adult dosage, itself subject to no little uncertainty. Nor can deductions as to the efficacy of a given dose be drawn from the action of drugs with which the agent is naturally associated. A single drop of laudanum has been known to produce the death of an infant, whereas large doses of belladonna, conium, arsenic, and mercury have been taken with comparative impunity.

The most convenient rule (Young's) adds 12 to the child's age and divides by the age to get a denominator of a fraction whose numerator is 1, this fraction representing the proportion between adult and infant doses. Thus, for a child three years old $\frac{3+12}{3} = 5$, or $\frac{1}{5}$, the dose being one-fifth of that given to an adult.

Temperament acts as an important agent in modifying the effect of medicinal remedies, phlegmatic subjects readily tolerating certain medicines, such as opium, which those of nervous temperament are unable to bear. Stimuli act upon sanguineous patients forcibly, yet upon others their influence may be either tardy or ineffectual. The condition is one which discloses a wide field of inquiry, the mental, moral, and physical tendencies of the individual being involved in the practical administration of medicines.

Closely allied to the foregoing is the question of *Idiosyncrasy*, the constitutional peculiarity which exerts a subtle influence, scarcely understood, as potent as it is obscure. Its characteristics cannot be formulated, but must be studied with the aid of experience—an odor, a taste, a casual or fixed impression, or hereditary instinct often determining their existence and manifestation. In temperament and idiosyncrasy, indeed, the psychological rather than the

physiological side of therapeutics is developed, requiring for its treatment a professional acumen not always at command.

The influence of *Habit* is to diminish the susceptibility of the organism to impressions which under normal conditions would be speedy and effectual. Only by gradually increasing the quantity of the dose can results be obtained which in ordinary circumstances require few exhibitions. Thus, patients accustomed to the use of alcoholic stimulants accept heroic doses of alcohol with little or no indication of the effects quickly perceptible in temperate subjects.

Bodily condition obviously affects the action of remedial agents. It is well established that in severe pain opium may be administered in quantities which in a healthy organism would produce untoward, perhaps fatal, results. The salivation occasionally caused by mercury is seldom apparent in febrile conditions. Yet in cases where sensibility is diminished great care is necessary to avoid the deleterious effects of over-stimulation or excessive dosage.

Respecting *Sex*, although it is generally admitted that females require smaller doses than males, the exceptions to the rule are so numerous as almost to vitiate the accepted theory.

The *Time of Administration* is closely connected with the *Form of the Remedy* given, as a rule remedies being withheld immediately before and after meals. The practice, however, is subject to modifications, certain drugs acting best on an empty stomach, and others, such as local irritants, being more safely diffused when the stomach is full, in which case by mingling with the food they are not brought into irritating contact with the intestinal mucous membranes.

With regard to *Intervals between Doses* it may be said, in brief, that they are to be determined by the special features of the case, the character and potency of the drug, and the degree of tolerance and assimilation evidenced by the patient. Every remedial agent, under normal conditions, produces a specific and definite action, the system by absorption and elimination limiting the period of its efficacy in cases of prolonged treatment, so that the drug is evidently to be renewed in order to secure perfect results. Failure to continue treatment has frequently proved disastrous, even fatal, to the patient, and it should be borne in mind that, in the absence of contraindications or untoward effects, a primary object of dosage is to create and maintain an impression upon the morbid system. Knowledge of therapeutic action and a thorough understanding of pathological conditions can best determine the interval requisite to attain the most beneficial effect of successive dosage.

Other considerations—by some therapeutists held to be of minor, by others of paramount, importance—affect the vital question of dosage. The emotions, for example, play an interesting part in the toleration or rejection of remedial agents. Strangely enough, too, the imaginative faculty is often a cause of idiosyncrasy, numerous instances being adduced by reputable authorities wherein either positive or fancied ills were affected through the agency of spurious remedies—bread-pills, deceptive concoctions, and the like—the ethical aspect of therapeutics being here left to the conscience of the physician.

UNTOWARD EFFECTS OF DRUGS.

DRUGS given a specified patient, a victim of acquired or inherited defect, will produce in that patient unexpected results differing from their usual action. These results, which should not be classified with typically poisonous effects or with those of prolonged use, may not appear in many cases, and do not correspond, as a rule, with the admittedly poisonous symptoms. They have been termed in Germany "nebenwirkungen," in France "inconvénients thérapeutiques," and among the English-speaking nations "untoward effects" and "bye-effects." The following summary has been made of these from those tabulated by Drs. W. L. Baum, and J. G. Kiernan of Chicago, Lewin of Berlin, Germany, and Mulheron of Detroit, Mich.

Untoward effects are of great interest from a medico-legal standpoint. Even physicians are but too apt to refer them to defects or impurities in the drug dispensed. They are seemingly multiform in character, and yet they can readily be ranged under a few general laws. The primary and secondary effects, which are often opposite in nature, the organs chiefly affected by the ordinary action of the drug, the method of drug-excretion, all play a part in what may be called general constitutional untoward effects, as contrasted with the untoward manifestations due to temporary and evanescent conditions, which last, however, also range themselves in a regulated fashion.

Prediction may be made with considerable accuracy as to the untoward effects of any drug on learning its action and all the factors cited. An antipyretic will have as untoward effects, skin-eruption because it is excreted through the skin, because the skin through its pores regulates temperature, and hence is under control of the central nervous system regulating temperature, and, finally,

because the skin is in close connection from an early period with the nervous system. For the same reason profuse, debilitating perspiration often results. Since control of the temperature cannot be effected without control of the vasomotor system regulating the blood-supply, heart-failure, collapse, and palpitation may result, together with certain eye- and ear-symptoms.

If the drug be one which tends to cause slight brain vasomotor disturbance, such as results from what is known as a tonic action, then delirium, blindness, and deafness of a temporary character are produced. Temperature in the human subject is regulated by the three systems of nerves: thermotaxic or heat-regulating, thermo-excitory or heat-increasing, and thermo-inhibitory or heat-decreasing. As a more or less exact balance is kept by these centers, undue action of any of them constitutes a morbid state. If the thermo-inhibitory centers be too much stimulated, they may lose their control: hence in certain individuals temperature rises after an antipyretic.

Hahnemann, an individual with a neurotic constitution, had an easily upset temperature-regulator, whence his experiments on himself with cinchona resulted in this phenomenon, which has since been observed by Denk and others from quinine and cinchona preparations. The action on the heart may, by its influence on the kidney-circulation, cause kidney- and bladder-symptoms even to the extent of albumin in the urine. If the antipyretic be excreted through the kidneys, albuminuria is especially likely to present itself as an untoward result. Alteratives and purgatives produce hemorrhages from the mucous membranes and swelling of those of the organs of special sense, beside skin-eruptions. Hypnotics through their action on the central nervous system produce excessive perspiration, skin-eruptions, vertigo, and heart-collapse. Astringents cause diarrhea and bloody intestinal discharges. Diaphoretics cause pains at certain points from over-stimulation. Pilocarpine causes at times pain in the penis; as there often occur in certain persons excessive secretion and plugged sebaceous glands around its head, the pain and other resultant symptoms simulate chancre.

In classifying tonics and alteratives together in the first table the influences of the trophic nervous system, evident in the constitutional changes produced by diseases like typhoid fever, must be taken into account. Alterative drugs have much the same constitutional effects, according to the theory of their action now coming into general acceptance.

It will be observed from the annexed tables (see pages 36–41) that the most potent tonics and alteratives are most fertile in

TABLE I.—*Alteratives and Tonics.*

	General.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Arsenic	Fever, gastralgia, nausea, bulimia, salivation, profuse sweating, diarrhea, purpura.	Vertigo, ataxic symptoms, local anesthesia.	Eyelid edema, glottis edema, catarrh, amblyopia, tinnitus.	Vesicles, pustules, papules, erythema, urticaria, purpura.	Dysuria, icterus, hematuria, glycosuria, cystitis, albuminuria.
Chelidonium . . .	Nausea.	Vertigo.	Tinnitus.	Pruritus.	Albuminuria.
Cod-liver oil	Nausea.	Vertigo.		Vesicles.	
Colchicum	Nausea, gastralgia, like guaiac.	Like guaiac.	Like guaiac.	Vesicles.	Cystitis, strangury.
Columbo	Fever.	Vertigo, contractions.	Conjunctivitis, tinnitus.	Erythema.	Dysuria.
Cresole	Fever, nausea.	Vertigo.	Eyelid edema, tinnitus.	Erythema, papules.	Cystitis.
Gold	Fever, salivation, epistaxis.	Vertigo, emotional exaltation, aphrodisia.	Tinnitus.	Erythema, papules.	Cystitis.
Guaiac	Fever, profuse sweating.	Vertigo, ataxic symptoms, neuralgia.	Glottis edema, tinnitus.	Vesicles.	Cystitis, strangury.
Iodine	Bulimia, gastralgia, cardiac disorder, hemoptysis, dyspnea, fever, epistaxis, nausea.	Aphrodisia, ataxic symptoms, vertigo, delirium.	Amblyopia, catarrh, glottis edema, eyelid edema, diplopia, tinnitus, salivation.	Erythema, vesicles, papules, pustules, purpuric eruptions, urticaria.	Dysuria, cystitis, glycosuria, albuminuria.
Iron	Hemoptysis, hematemesis, nausea, gastralgia, fever, diarrhea, constipation.	Vertigo, ataxic symptoms, insomnia.	Eyelid edema, glottis edema, amblyopia, tinnitus.	Vesicles, purpuric eruption, pustules.	Hematuria, albuminuria, glycosuria, icterus.
Mercury	Fever, gastralgia, diarrhea, constipation, bulimia.	Insomnia, ataxic symptoms, insanity, local sensory troubles.	Eyelid edema, amblyopia, tinnitus, glottis edema.	Like iodides and quinine, tongue ulceration, salivation.	Dysuria, cystitis, hematuria, glycosuria.
Quassia	Nausea.	Vertigo, contractions.	Tinnitus.	Papules.	Dysuria.
Quinine	Fever, nausea, bulimia, hemoptysis, profuse sweating, dyspnea.	Delirium, insanity, ataxic symptoms, local sensory troubles, vertigo.	Amblyopia, photophobia, deafness, tinnitus.	Simulates scarlet fever, vesicles, papules, pustules, erythema, urticaria, purpura.	Hematuria, cystitis, albuminuria, glycosuria, icterus.
Salicylic Acid . . .	Profuse perspiration, bulimia, hemoptysis.	Vertigo, delirium, insanity, ataxic symptoms, local sensory troubles.	Dim sight, deafness, tinnitus.	Vesicles, pustules, pruritus, gangrene, purpura.	Cystitis, glycosuria, icterus.
Sarsaparilla	Nausea, gastralgia, bulimia, profuse sweat.	Vertigo, ataxic symptoms.	Glottis edema, tinnitus.	Eczema.	Cystitis, strangury.

Strychnine	Fever, dyspnea.	Vertigo, ataxic symptoms, local sensory troubles.	Conjunctivitis, photophobia, tinnitus.	Erythema, pruritus.	Albuminuria, glycosuria, cystitis.
Turpentine	Fever, nausea.	Vertigo, drowsiness, stupor.	Tinnitus.	Vesicles, erythema.	Albuminuria, cystitis, strangury, hematuria.

TABLE II.—*Neurotics, Narcotics, Antipyretics, and Hypnotics.*

	General. Lungs and Heart.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Acetanilid or Antifebrin.	Cardiac failure, lung edema, cyanosis, fever, pallor, hyperidrosis, nausea, diarrhea.	Anesthesia, hyperesthesia, vertigo, delirium, stupor, ataxia.	Amblyopia, xerostoma, throat constriction, tinnitus, pupil irregularity, conjunctivitis.	Erythema, vesicles, papules.	Icterus, dysuria, cystitis, albuminuria, glycosuria.
Aconite	Nausea, diarrhea, salivation, hyperidrosis, collapse, cyanosis.	Vertigo, anesthesia, paresthesia, hyperesthesia.	Amblyopia, tinnitus, xerostoma.	Erythema, urticaria.	Icterus, polyuria.
Amyl Nitrite . . .	Like glonoin.	Like glonoin.	Like glonoin.	Like glonoin.	Like glonoin.
Antikamnia	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid.
Antipyrin	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid, cystalgia.
Arnica	Tenesmus, bradycardia, diarrhea, collapse.	Stupor, vertigo, headache.	Xerostoma, amblyopia, throat irritability.	Erythema, urticaria, papules, pruritus.	Cystalgia, dysuria.
Atropine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Belladonna	Diarrhea, nausea, vomiting, collapse, hyperidrosis, fever, cardiac pain, dysphagia, dyspnea.	Delirium, insanity, stupor, vertigo, ataxia.	Amblyopia, lachrymation, xerostoma, tinnitus.	Erythema, vesicles, papules, purpura, pruritus.	Cystalgia, dysuria, polyuria.
Bromides	Collapse, cardiac failure, lung edema, gastralgia, vomiting, aphrodisia, amenorrhea, pneumonia.	Delirium, insanity, stupor, ataxia, convulsions, anesthesia, hyperesthesia.	Throat anesthesia, coryza, laryngismus stridulus, conjunctivitis, amblyopia, myopia, diplopia, fetid breath.	Acne, papules, vesicles, urticaria, erythema, pruritus.	Dysuria, cystalgia, icterus, polyuria, glycosuria.
Caffeine	Bradycardia.	Delirium, insanity.	Diplopia.	Erythema, vesicles.	Dysuria.
Camphor	Diarrhea, collapse, aphrodisia, hyperidrosis, vomiting.	Delirium, insanity, stupor, hyperesthesia, headache.	Xerostoma, coryza, amblyopia, tinnitus.	Erythema, vesicles.	Dysuria, polyuria, cystalgia, strangury.

TABLE II.—*Neurotics, Narcotics, Antipyretics, and Hypnotics* (CONTINUED).

	General. Lungs and Heart.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Cannabis Indica . .	Aphrodisia, vomiting, diarrhea, amenorrhea.	Vertigo, delirium, insanity, ataxia.	Amblyopia, tinnitus.	Erythema, vesicles.	Dysuria, cystalgia.
Chloralamid . . .	Like chloral.	Like chloral.	Like chloral.	Like chloral.	Like chloral.
Chloralose	Like chloral.	Like chloral.	Like chloral.	Like chloral.	Like chloral.
Chloral Hydrate . .	Dyspnea, lung edema, heart-failure, fever, diarrhea, hyperidrosis, bradycardia.	Vertigo, ataxia, stupor, delirium, convulsions, analgesia, anesthesia, hyperesthesia.	Epiglottis edema, amblyopia, photophobia, conjunctivitis, choroiditis, tinnitus.	Erythema, acne, purpura, papules, urticaria, pruritus.	Icterus, dysuria, strangury, glycosuria, albuminuria.
Chloroform	Fever, collapse, aphrodisia, diarrhea, hyperidrosis.	Vertigo, delirium, ataxia.	Amblyopia, like chloral.	Like chloral.	Like chloral.
Cocaine	Anaphrodisia, collapse, diarrhea, constipation, nausea, fever, amenorrhea, tenesmus.	Vertigo, ataxia, hyperesthesia, delirium, insanity.	Like opium.	Like opium.	Icterus, strangury, dysuria, polyuria.
Codeine	See *Opium*.				
Conium	Nausea, vomiting, bradycardia.	Ataxia, stupor, hyperesthesia.	Amblyopia.	Erythema.	Dysuria, polyuria.
Digitalis	Cardiac failure, dyspnea, dysphagia, nausea.	Headache, vertigo, stupor, insanity, ataxia.	Amblyopia.	Erythema.	Dysuria, polyuria, strangury, glycosuria.
Duboisine	See *Belladonna*.				
Ergot	Nausea, vomiting, gastralgia, bradycardia, fever, cyanosis.	Convulsions, vertigo, ataxia, hyperesthesia, delirium, insanity.	Amblyopia, tinnitus, photophobia.	Erythema, papules, urticaria.	Icterus, glycosuria, strangury.
Ether	Pallor, cyanosis.	Vertigo, delirium.	Salivation, laryngismus stridulus, amblyopia, tinnitus.	Erythema, urticaria.	Icterus, glycosuria.
Exalgin	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Gelsemium	Dyspnea, coryza.	Vertigo.	Amblyopia.	Erythema.	Strangury, icterus.
Glonoin	Dyspnea, coryza.	Vertigo, ataxia, analgesia.	Amblyopia.	Erythema.	Strangury glycosuria.

Holocaine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Homatropine . . .	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Hydracetin	Fever, nausea, cardiac irritability, dyspnea, nausea.	Vertigo, delirium, ataxia, numbness.	Pupil immobility, amblyopia, conjunctivitis, throat irritability.	Erythema, purpura.	Strangury, hematuria.
Hyoscyamus, Hyoscyamine, Hyoscine,	Like hydracetin.	Like hydracetin.	Like hydracetin.	Erythema, papules, and pustules.	Icterus, bladder-irritability.
Kryofine	Dyspnea, coryza, hyperidrosis.	Like hydracetin, except as to delirium.	Amblyopia.	Erythema.	Polyuria, dysuria.
Methylal	Like kryofine.	Like hydracetin, stupor.	Diplopia, amblyopia.	Erythema, urticaria.	Polyuria, bladder irritability.
Methacetin	Hyperidrosis, like hydracetin.	Like hydracetin.	Amblyopia, diplopia.	Erythema.	Like methylal.
Monobromacetanilid	Fever, syncope, hyperidrosis, cyanosis.	Vertigo, stupor, headache, numbness, hyperesthesia.	Amblyopia.	Erythema.	Like methylal.
Musk	Nausea, aphrodisia, fever.	Like monobromacetanilid.	Throat irritability, amblyopia.	Erythema.	Dysuria.
Opium, Morphine, Codeine,	Nausea, diarrhea, gastralgia, dyspnea, aphrodisia, fever, hyperidrosis.	Vertigo, stupor, convulsions, insanity, headache, paresthesia.	Throat irritability, amblyopia, yellow vision, accommodation spasm.	Erythema, vesicles, papules, purpura, pruritus, urticaria.	Dysuria, glycosuria, icterus.
Paraldehyde . . .	Like opium, cyanosis, gastralgia.	Like opium.	Like opium.	Like opium.	Like opium.
Pental	Like ether.	Like ether.	Like ether.	Like ether.	Like ether.
Phenacetin	Fever, collapse, dyspnea, hyperidrosis, cyanosis.	Vertigo, ataxia, stupor, hyperesthesia.	Amblyopia, tinnitus, diplopia.	Erythema, urticaria.	Dysuria, glycosuria, icterus.
Phenocol	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Physostigma . . .	Nausea, gastralgia, vomiting.	Vertigo, mastalgia, delirium, ataxia.	Tinnitus, amblyopia.	Pruritus, erythema, urticaria.	Dysuria, icterus.
Phytolacca	Like physostigma.	Like physostigma.	Like physostigmin.	Like physostigmin.	Dysuria.
Pulsatilla	Coryza, dyspnea, cardiac irritability.	Orchialgia, mastalgia.	Amblyopia, eye-pain, tinnitus.	Erythema.	Dysuria, polyuria.
Scopolamine . . .	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Serosin	Like methacetin.	Like methacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Stramonium	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Sulphonal	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.

TABLE II.—*Neurotics, Narcotics, Antipyretics, and Hypnotics* (CONTINUED).

	General. Lungs and Heart.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Cannabis Indica . .	Aphrodisia, vomiting, diarrhea, amenorrhea.	Vertigo, delirium, insanity, ataxia.	Amblyopia, tinnitus.	Erythema, vesicles.	Dysuria, cystalgia.
Chloralamid . . .	Like chloral.	Like chloral.	Like chloral.	Like chloral.	Like chloral.
Chloralose	Like chloral.	Like chloral.	Like chloral.	Like chloral.	Like chloral.
Chloral Hydrate . .	Dyspnea, lung edema, heart-failure, fever, diarrhea, hyperidrosis, bradycardia.	Vertigo, ataxia, stupor, delirium, convulsions, analgesia, anesthesia, hyperesthesia.	Epiglottis edema, amblyopia, photophobia, conjunctivitis, choroiditis, tinnitus.	Erythema, acne, purpura, papules, urticaria, pruritus.	Icterus, dysuria, strangury, glycosuria, albuminuria.
Chloroform	Fever, collapse, aphrodisia, diarrhea, hyperidrosis.	Vertigo, delirium, ataxia.	Amblyopia, like chloral.	Like chloral.	Like chloral.
Cocaine	Anaphrodisia, collapse, diarrhea, constipation, nausea, fever, amenorrhea, tenesmus.	Vertigo, ataxia, hyperesthesia, delirium, insanity.	Like opium.	Like opium.	Icterus, strangury, dysuria, polyuria.
Codeine	See *Opium*.				
Conium	Nausea, vomiting, bradycardia.	Ataxia, stupor, hyperesthesia.	Amblyopia.	Erythema.	Dysuria, polyuria.
Digitalis	Cardiac failure, dyspnea, dysphagia, nausea.	Headache, vertigo, stupor, insanity, ataxia.	Amblyopia.	Erythema.	Dysuria, polyuria, strangury, glycosuria.
Duboisine	See *Belladonna*.				
Ergot	Nausea, vomiting, gastralgia, bradycardia, fever, cyanosis.	Convulsions, vertigo, ataxia, hyperesthesia, delirium, insanity.	Amblyopia, tinnitus, photophobia.	Erythema, papules, urticaria.	Icterus, glycosuria, strangury.
Ether	Pallor, cyanosis.	Vertigo, delirium.	Salivation, laryngismus stridulus, amblyopia, tinnitus.	Erythema, urticaria.	Icterus, glycosuria.
Exalgin	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Gelsemium	Dyspnea, coryza.	Vertigo.	Amblyopia.	Erythema.	Strangury, icterus.
Glonoin	Dyspnea, coryza.	Vertigo, ataxia, analgesia.	Amblyopia.	Erythema.	Strangury glycosuria.

Holocaine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Homatropine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Hydracetin	Fever, nausea, cardiac irritability, dyspnea, nausea.	Vertigo, delirium, ataxia, numbness.	Pupil immobility, amblyopia, conjunctivitis, throat irritability.	Erythema, purpura.	Strangury, hematuria.
Hyoscyamus, Hyoscyamine, Hyoscine,	Like hydracetin.	Like hydracetin.	Like hydracetin.	Erythema, papules, and pustules.	Icterus, bladder-irritability.
Kryofine	Dyspnea, coryza, hyperidrosis.	Like hydracetin, except as to delirium.	Amblyopia.	Erythema.	Polyuria, dysuria.
Methylal	Like kryofine.	Like hydracetin, stupor.	Diplopia, amblyopia.	Erythema, urticaria.	Polyuria, bladder irritability.
Methacetin	Hyperidrosis, like hydracetin.	Like hydracetin.	Amblyopia, diplopia.	Erythema.	Like methylal.
Monobromacetanilid	Fever, syncope, hyperidrosis, cyanosis.	Vertigo, stupor, headache, numbness, hyperesthesia.	Amblyopia.	Erythema.	Like methylal.
Musk	Nausea, aphrodisia, fever.	Like monobromacetanilid.	Throat irritability, amblyopia.	Erythema.	Dysuria.
Opium, Morphine, Codeine,	Nausea, diarrhea, gastralgia, dyspnea, aphrodisia, fever, hyperidrosis.	Vertigo, stupor, convulsions, insanity, headache, paresthesia.	Throat irritability, amblyopia, yellow vision, accommodation spasm.	Erythema, vesicles, papules, purpura, pruritus, urticaria.	Dysuria, glycosuria, icterus.
Paraldehyde	Like opium, cyanosis, gastralgia.	Like opium.	Like opium.	Like opium.	Like opium.
Pental	Like ether.	Like ether.	Like ether.	Like ether.	Like ether.
Phenacetin	Fever, collapse, dyspnea, hyperidrosis, cyanosis.	Vertigo, ataxia, stupor, hyperesthesia.	Amblyopia, tinnitus, diplopia.	Erythema, urticaria.	Dysuria, glycosuria, icterus.
Phenocol	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Physostigma	Nausea, gastralgia, vomiting.	Vertigo, mastalgia, delirium, ataxia.	Tinnitus, amblyopia.	Pruritus, erythema, urticaria.	Dysuria, icterus.
Phytolacca	Like physostigma.	Like physostigma.	Like physostigmin.	Like physostigmin.	Dysuria.
Pulsatilla	Coryza, dyspnea, cardiac irritability.	Orchialgia, mastalgia.	Amblyopia, eye-pain, tinnitus.	Erythema.	Dysuria, polyuria.
Scopolamine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Serosin	Like methacetin.	Like methacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Stramonium	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Sulphonal	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.

TABLE II.—*Neurotics, Narcotics, Antipyretics, and Hypnotics* (CONTINUED).

	General. Lungs and Heart.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Tetronal, Trional,	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.	Like methacetin.
Valerian	Nausea, diarrhea, aphrodisia, enteralgia, gastralgia.	Paresthesia, vertigo, delirium.	Throat constriction, tinnitus, amblyopia.	Pruritus, erythema, papules.	Dysuria, polyuria.
Veratrum	Collapse, dyspnea, cardiac pain, enteralgia, gastralgia.	Paresthesia, hyperesthesia, vertigo, convulsions, delirium.	Xerostoma, amblyopia.	Pruritus, petechiæ.	Dysuria.

TABLE III.—*Anthelmintics, Cathartics, Diaphoretics, Diuretics, Emetics, and Expectorants.*

	General. Lungs and Heart.	Brain and Cord.	Eye, Ear, and Throat.	Skin.	Liver, Kidneys, and Bladder.
Aloes	Vomiting, tenesmus.	Ataxia, vertigo.	Amblyopia.	Erythema, urticaria.	Hematuria.
Ammonium Chloride	Nausea, diarrhea.	Ataxia, vertigo.	Amblyopia.	Erythema.	Polyuria.
Buckthorn	Fever, diarrhea.	Ataxia, vertigo.	Amblyopia, tinnitus.	Erythema.	Icterus, polyuria.
Cascara	Like buckthorn.	Like buckthorn.	Like buckthorn.	Like buckthorn.	Like buckthorn.
Castor Oil	Vomiting, fever.	Like buckthorn.	Like buckthorn.	Like buckthorn.	Icterus.
Colocynth	Like castor oil.	Like buckthorn.	Like buckthorn.	Pruritus, erythema.	Icterus.
Copaiba	Fever, dyspnea, gastralgia, nausea, aphrodisia.	Vertigo, ataxia, spastic palsy.	Amblyopia, photophobia, conjunctivitis, pharyngitis, tinnitus.	Roseola, urticaria, erythema, pruritus, penis ulcers.	Cystitis, nephritis, dysuria.
Croton Oil	Nausea.	Vertigo.	Amblyopia, conjunctivitis.	Erythema.	Icterus, cystitis, nephritis.
Cubebs	See *Copaiba*.				
Elaterium	See *Colocynth*.	See *Colocynth*.			
Gamboge	See *Colocynth*.				
Gratiola	Aphrodisia, vomiting.	See *Colocynth*.			
Ipecac	Diarrhea.	Vertigo.	Amblyopia, tinnitus, salivation.	Pruritus, erythema.	Dysuria.
Iris	See *Colocynth*.				
Jaborandi	Nausea, collapse, fever, lung edema.	Vertigo, ataxia, penis-tip pain.	Amblyopia, tinnitus.	Erythema, pruritus.	Icterus, dysuria, polyuria.

Jalap	See *Colocynth.*				
Mule Fern	Nausea, fever.	Vertigo, ataxia.	Amblyopia, tinnitus.	Erythema, roseola.	Dysuria, cystalgia.
Podophyllum	See *Colocynth.*				
Pomegranate	Nausea, diarrhea.	Vertigo, ataxia.	Amblyopia, tinnitus.	Erythema.	Polyuria.
Pot. Chlorate	Nausea, diarrhea, fever.	Vertigo, delirium, ataxia.	Amblyopia, coryza, epistaxis.	Roseola, erythema.	Nephritis, icterus, cystitis, dysuria.
Rhubarb	Nausea, vomiting, constipation, penis hemorrhage.	Vertigo, ataxia.	Amblyopia, coryza, tinnitus.	Roseola, macules, erythema, urticaria.	Hematuria, dysuria.
Rhus	Nausea.	Vertigo, delirium, ataxia.	Amblyopia, deafness, tinnitus.	Macules, erythema.	Dysuria, cystitis.
Santonin	Nausea, diarrhea, gnstralgia, amenorrhea.	Vertigo, ataxia, insanity, delirium.	Amblyopia, photophobia, yellow vision, tinnitus.	Erythema, urticaria.	Icterus, dysuria.
Senega	Nausea, diarrhea, gastralgia.	Vertigo.	Amblyopia.	Erythema.	Dysuria.
Squills	Like senega.	Like senega.	Xerostoma, amblyopia, coryza, tinnitus.	Erythema.	Dysuria, hematuria.
Tartar Emetic	Nausea, cyanosis, collapse.	Vertigo.	Amblyopia, conjunctivitis.	Roseola, papules.	Nephritis, cystitis, dysuria.

untoward effects. This is naturally to be expected. A drug of potent physiological action must of necessity try more severely inherited and acquired deficiencies of constitution than an inert drug. Too excessive strain on inhibitions weakened by acquired or inherited taint gives an undue sway to inhibited centers. Untoward effects of drugs may hence be conditioned on pre-existing affections of the inhibitory apparatus of the system.

One influence which, together with hereditary or acquired defect, plays a part in determining untoward results is what the Germans call the "etiologic moment." This is excellently illustrated in the neurotics, which display such decidedly variable untoward effects. In many neuroses nerve-strain of the eliminative and assimilative organs has produced toxins and other products; some of these naturally add to the effects of a given neurotic drug, or direct these in some special channel or inhibit certain effects, thereby giving others undue play. This may constitute, as Lewin has shown, a disposition that is but temporary, which disposition may have its foundation either in a greater abundance in the system of bio-chemical substances, which cause an unusually prompt solution or action of the medicines introduced, or which may unite with them to form injurious compounds; or it may be conditional on pre-existing pathologic changes in the inhibitory apparatus of the system.

The tables given on pages 36–41, covering all the departments of the materia medica, will give a better idea of these untoward effects than any detailed description.

WEIGHTS AND MEASURES.

THE history of Weights and Measures affords a striking example of the incongruity resulting from the absence of a uniform standard of stable value to science, and must be regarded as the strongest argument in favor of the Metric, or Decimal, System.

An idea of the confusion prevailing under the old methods may be gained from an examination of their comparative units, by which we find that a pint is not a pound, an ounce not equal to a fluidounce, a drachm not equivalent to a fluidrachm, and a minim not commensurate with a grain. It was not until 1836 that the Secretary of the U. S. Treasury was directed by Congress to furnish each State in the Union with a complete set of revised standards, includ-

ing the *troypound* of 5760 grains, from which the Apothecaries', or Troy, weight is derived, the latter term at present being applied only to the system used in weighing precious metals.

For commercial purposes the following Weights and Measures are employed:

Avoirdupois Weights: the Pound divided into 16 Ounces.

Liquid Measures: the "Wine Measure," of which the *U. S. Gallon* represents a volume of 231 cubic inches; each cubic inch of water at the maximum density (4° C.) being equivalent to 252.892 grains, the weight of a Gallon being therefore 58,418 grains. The Gallon is divided into 8 Pints (octarius), and the Pint is divided into 16 Fluidounces, each containing 8 Fluidrachms, or 480 Minims, the Fluidrachm containing 60 Minims. The signs used to designate these units are—♏, denoting minim or minims; ƒ℥, fluidrachm or fluidrachms; and ƒ℥, fluidounce or fluidounces.

Apothecaries' (Troy) Weight.

20 grains (gr. *granum*)	= 1 scruple ℈ (*scrupulum*).
60 grains, or 3 scruples	= 1 drachm ʒ (*drachma*).
480 grains, or 8 drachms	= 1 ounce ℥ (*uncia*).
5,760 grains, or 12 ounces	= 1 pound ℔ (*libra*).

Apothecaries' (Wine) Measure.

60 minims (♏)	= 1 fluidrachm ƒ℥.
480 minims, or 8 fluidrachms	= 1 fluidounce ƒ℥.
7,680 minims, or 16 fluidounces	= 1 pint O (*octarius*).
61,440 minims, or 8 pints	= 1 gallon C (*congius*).

This lack of uniformity in the units and the denominations of the three systems of weights and measures is exemplified in the subjoined table. While the two weight systems have a unit in common, the grain, there is no correlation in the higher denominations, ounces and pounds. The desirability of adopting a fixed standard, applicable in all cases where great accuracy in weights and measures is requisite, has been frequently emphasized by writers on therapeutics. As we have premised, the present difficulty forms a cogent argument in favor of the *metric system*, as wisely adopted in the U. S. Pharmacopœia. A remarkable disparity is shown in the liquid measures, in which there is no unit in common: a minim is not a grain, nor "a pint a pound the world around."

Table of Apothecaries' Weight and U. S. Liquid Measure, showing the equivalents of the various denominations (by reading from the left-hand column and referring to headings), the weight equivalent of liquid measures being for water at 15° C.:

Symbol.	Minim.	Granum.	Scrupulus.	Drachma.	Fluid-drachma.	Av. ounce.	Fluid-uncia.	Uncia.	Libra.	Av. pound.	Octarius.	Congius.
♏.	1	0.95	. .	57	60	. .	480	. .	. .		7,680	61,440
gr.	0.95	1	20	60	57	437.5	456	480	5,760	7,000	7,300	58,400
℈	. .	20	1	3	. .	. .	. .	24	288	350	. .	. .
ʒ	63	60	3	1	. .	$7\frac{17}{20}$	. .	8	96	$116\frac{2}{3}$	. .	. .
f℥	60	57	. .	$\frac{19}{20}$	1	$7\frac{3}{8}$	8	$8\frac{1}{3}$	100	$110\frac{2}{3}$	128	1024
av. oz.	. .	437.5	. .	$7\frac{7}{16}$	$7\frac{3}{8}$	1	$1\frac{7}{16}$	0.9115	$13\frac{1}{3}$	16	$16\frac{3}{8}$	. .
fl. ℥	480	456	. .	. .	8	$\frac{32}{35}$	1		.	. .	16	128
℥	. .	480	24	8	. .	$1\frac{1}{10}$	. .	1	12	14.58	. .	. .
lb.	. .	5,760	288	96	. .	. .	. .		1	1.215	. .	. .
lb. av.	. .	7,000	350	$116\frac{2}{3}$	. .	16	. .	14.58	0.823	1	. .	. .
O.	7,680	7,292	. .	. .	128	. .	16		. .	. .	1	8
Cong.	61,440	. .	. .	. .	1,024	. .	128		. .	. .	8	1
	Minim.	Grain.	Scruple.	Drachm.	Fluid-drachm.	Av. oz.	Fluid-ounce.	Apoth. or Tr. oz.	Apoth. or Tr. pound.	Av. pound.	Pint.	Gallon.

THE METRIC SYSTEM.

The Metric System of Weights and Measures, destined to supplant all others, originated with Prince de Talleyrand, bishop of Autun, in 1790. Its almost universal adoption by civilized nations, its legality, though not compulsion, in England and the United States, and its adoption by the U. S. Pharmacopœia of 1890, require that it should be understood alike by the physician and the druggist. Save in the English-speaking world it is the only system used for governmental, statistical, and scientific purposes, and in the arts and manufactures its value has long since been recognized. Its extreme simplicity, its uniformity, and its facility of computation render it far superior to any other system of Weights and Measures, and it is highly probable that in the near future it will prevail in the transactions of every-day life, as it has already acquired international importance, and is in fact referred to as the International System.

The starting-point is the *unit of length*, the meter (*mètre*), which is the $\frac{1}{40000000}$ part of the earth's circumference around the poles.[1] From this apparently irrelevant measure of length the *unit of*

[1] In 1806, François Arago and Biot were commissioned by the French government to complete the meridional measurements interrupted in 1804. The object of their survey was to determine, with as great nicety as possible, the ten-millionth part of a quadrant of the meridian passing through Paris, which had been chosen by the National Convention as the standard unit of length, and named the *mètre*. It being impossible to measure from the poles, an arc of the meridian, equalling a quadrant, from Dunkirk to Barcelona was selected, and from their known difference of latitude the entire length of the arc was deducted.

capacity, or volume, the *liter*, was established, it being the cube of $\frac{1}{10}$ of a meter. With equal simplicity and clearness, from the meter was derived the *unit of weight*, the *gramme*, which is the weight of that quantity of pure water at the maximum density, 4° C. (39.2° F.), which will fill the cube of $\frac{1}{100}$ part of a meter[1] (cubic centimeter).

The Metric is also known as the *Decimal System*, because its multiples and subdivisions are obtained by ten (Lat. *decem*). The prefixes denoting *multiplication* are of Greek derivation, and are usually spelled with a capital letter: Deka 10, Hecto 100, Kilo 1000, Myria 10,000. *Division* of the units is indicated by Latin prefixes, not capitalized: deci $\frac{1}{10}$, centi $\frac{1}{100}$, milli $\frac{1}{1000}$. To distinguish readily one process from the other the word GILD has been aptly suggested as a mnemonic:

G	I	L	D.
Greek	increases,	Latin	decreases.

It may be observed that, strangely enough, while we still oppose the general adoption of the Metric System, our enumeration is *decimal*. We count from one to ten, and begin a new, yet similar, series of another ten units, and so on indefinitely,. We compute money in dollars, dimes, cents, and mills, *decimally*, and our record of time—years, decades, centuries—is in harmony with *decimal* arithmetic.

Even the provision of the Federal Constitution declaring that a national census be taken every *ten* years is pertinent as a suggestion of decimal convenience; and in the period prescribed for the State censuses, every five years, *one-half of ten*, there is no great deviation from the same principle of utility.

Contrary to a prevalent opinion, the Metric System is easily mastered. A perfect acquaintance with the metric tables is, naturally, indispensable, and the abbreviations for the different weights and measures should be thoroughly at command. For the rest, the system is simply that of arithmetical decimals, requiring chiefly a correct use of the decimal point. Only a tyro would read .065 *six and five-tenths hundredths* instead of *sixty-five thousandths;* so Gm. .065 would never be read by one acquainted with decimals

[1] The unit of *surface* measure, the *are*, the square of ten meters, and the unit of the *solid* measure, the *stere*, having the capacity of a cubic meter, need not claim the attention of the physician or the practical pharmacist.

six centigrammes and five milligrammes, but *sixty-five milligrammes.*

Metric Table of Lengths.

10 millimeters	make	1 centimeter.
10 centimeters	"	1 decimeter.
10 decimeters	"	1 Meter.
10 Meters	"	1 Dekameter.
10 Dekameters	"	1 Hectometer.
10 Hectometers	"	1 Kilometer.
10 Kilometers	"	1 Myriameter.

Abbreviations for the different divisions and multiples of the Meter are herewith given, together with their equivalents in inches, showing that the written system depends wholly upon the place of the *decimal point*, the figures remaining unchanged. It may be noted that the first abbreviations cited are those commonly in use, although in certain cases the second are preferable:

Metric Table of Linear Measure.

1 millimeter	is written	1 mm.,	or	M .001,	equal in inches to	.039370432,	approx.	$\frac{1}{25}$.
1 centimeter	"	1 cm.,	"	M .01,	" "	.39370432,	"	0.4.
1 decimeter	"	1 dm.,	"	M .1,	" "	3.9370432,	"	4.
1 Meter	"	1 M.,	"	M 1.,	" "	39.370432,	"	40.
1 Dekameter	"	1 Dm.,	"	M 10.,	" "	393.70432		
1 Hectometer	"	1 Hm.,	"	M 100.,	" "	3937.0432		
1 Kilometer	"	1 Km.,	"	M 1000.,	" "	39370.432		
1 Myriameter	"	1 Mm.,	"	M 10000.,	" "	393704.32		

The term *micromillimeter*, one-thousandth of a *millimeter* (0.000001), is used, especially in microscopy, the abbreviations being mmm., mic., mkm., or the Greek letter μ.

Metric Table of Capacities.

10 milliliters	make	1 centiliter.
10 centiliters	"	1 deciliter.
10 deciliters	"	1 Liter.
10 Liters	"	1 Dekaliter.
10 Dekaliters	"	1 Hectoliter.
10 Hectoliters	"	1 Kiloliter.
10 Kiloliters	"	1 Myrialiter.

Abbreviations for the different divisions and multiples of the Liter, with their corresponding equivalents in minims or ounces, are as follows:

1 milliliter is written	1 Cc.[1]	or L .001,	equal in minims to			16.23
1 centiliter	" 1 cl.	" L .01,	"	"		162.3
1 deciliter	" 1 dl.	" L .1,	"	"		1623.
1 Liter	" 1 L.	" L 1.,	"	fl. ounces		33.814
1 Decaliter	" 1 Dl.	" L 10.,	"	"		338.14
1 Hectoliter	" 1 Hl.	" L 100.,	"	"		3381.4
1 Kiloliter	" 1 Kl.	" L 1000.,	"	"		33814.
1 Myrialiter	" 1 Ml.	" L 10000.,	"	"		338140.

Metric Table of Weights.

10 milligrammes	make	1 centigramme.
10 centigrammes	"	1 decigramme.
10 decigrammes	"	1 Gramme.
10 Grammes	"	1 Dekagramme.
20 Dekagrammes	"	1 Hectogramme.
10 Hectogrammes	"	1 Kilogramme.
10 Kilogrammes	"	1 Myriagramme.

Abbreviations for the different divisions and multiples of the Gramme, with their corresponding equivalents in grains, are as follows:

1 milligramme is written	1 mg.,	or Gm. .001,	equal in grains to	($\frac{1}{64}$)	.015432
1 centigramme	" 1 cg.,	" Gm. .01,	"	"	($\frac{1}{8}$)	.15432
1 decigramme	" 1 dg.,	" Gm. .1,	"	"		1.5432
1 Gramme	" 1 Gm.,	" Gm. 1.,	"	"		15.432
1 Dekagramme	" 1 Dg.,	" Gm. 10.,	"	"		154.32
1 Hectogramme	" 1 Hg.,	" Gm. 100.,	"	"		1543.2
1 Kilogramme	" 1 Kg.,	" Gm. 1000.,	"	"		15432.3
1 Myriagramme	" 1 Mg.,	" Gm. 10000.,	"	"		154323.4

METHOD OF CONVERTING METRIC WEIGHTS, MEASURES, AND LENGTHS INTO THOSE IN COMMON USE, AND VICE VERSA.

Approximate Table of Weights.

1 grain	=	0.65 Gm. (65 milligrammes).
15½ grains	=	1. Gm.
1 drachm	=	3.9 Gm.
1 troy ounce	=	31.1 Gm.

Approximate Table of Capacities.

1 minim	=	.06 Cc.
16 minims	=	1. Cc.
1 fluidrachm	=	3.75 Cc.
1 fluidounce	=	30. Cc.

[1] This is designated by Cc. instead of Ml, and in practice only cubic centimeters and Liters are employed.

Approximate Table of Lengths.

1 inch = .025 M. (25 millimeters).
40 inches = 1. M.

Weights.

To Convert Grains into the Corresponding Metric Equivalents.— It has been seen that 1 *grain* is equal to Gm. .065. In order, then, to convert *grains* or fractions of a *grain* into the corresponding metric quantity, we have simply to *multiply* the number of grains by .065.

2 grains	=	2	×	.065, or .130	Gm.
60 grains	=	60	×	.065, " 3.9	Gm.
½ grain	=	½	of	.065, " .0325,	Gm.
$\frac{1}{100}$ grain	=	$\frac{1}{100}$	of	.065, " .00065	Gm., etc.

To Convert Metric Quantities into their Equivalent in Grains.— Instead of multiplying as above, *divide*, using the same number, .065, as a *divisor*.

Gm. .130	=	.130	÷	.065, or	2 grains.
Gm. 3.9	=	3.9	÷	.065, "	60 grains.
Gm. .0325	=	.0325	÷	.065, "	.5 grain.
Gm. .00065	=	.00065	÷	.065, "	.01 grain.

It follows that to convert Apothecaries' drachms into Grammes we *multiply* the number of drachms by 3.9, the number of Grammes in 1 drachm; and to convert Grammes into Apothecaries' drachms we *divide* the number of Grammes by 3.9.

The same rule applies to the conversion of Apothecaries' ounces into Grammes and Grammes into ounces, the multiplier and divisor being 31.1, the number of Grammes in 1 ounce.

Volumes.

To convert minims into the corresponding metric equivalents, *multiply* the number or fractions of minims by .06, this being the equivalent in Cc. of 1 minim; and to convert the metric quantities into the corresponding equivalents in minims, *divide* the metric quantity by .06. To convert fluidrachms into Cc., *multiply* the number of drachms by 3.75, the number of Cc. in 1 fluidrachm; and to convert Cc. into fluidrachms, divide the number of Cc. by 3.75. To convert fluidounces into Cc., *multiply* the number of ounces by 30. Cc., the equivalent of 1 fluidounce; and to convert Cc. into fluidounces, divide the number of Cc. by 30.

For convenience of ready reference and to facilitate computation the following tables are subjoined:

Table of Metric Equivalents

of Grains, Drachms, Minims, and Fluidrachms.

℥	Grains.	Milligrams, mg.	Centigrams, cg.	Decigrams, dcg.	Grammes, Gm.	Minims.	Cubic centimeters, Cc.	ℨ
	1/100	0.65	0.065	0.0065	0.00065			
	1/75	0.85	0.085	0.0085	0.00085			
	1/64	1.	0.1	0.01	0.001			
	1/50	1.3	0.13	0.013	0.0013			
	1/25	2.5	0.25	0.025	0.0025			
	1/10	6.5	0.65	0.065	0 0065			
	1/8	13.	1.3	0.13	0.013			
	1/4	16.	1.6	0.16	0.016			
	1/2	32.	3.2	0.32	0.032			
	1	65.	6.5	0.65	0.065	1	0.06	
	2		13.	1.3	0.13	2	0.12	
	3		20.	2.	0.2	3	0.18	
	4		25.	2.5	0.25	4	0.24	
	5		30.	3.	0.3	5	0.3	
	7½		50.	5.	0.5	8	0.5	
	10		65.	6.5	0.65	10	0.6	
	15		100.	10.	1.	16	1.	
	20			13.	1.3	20	1.25	
	30			20.	2.	32	2.	
℥j	60			40.	4.	60	3.75	fℨj
	100			65.	6.5	100	6.	
℥ij	120			80.	8.	120	7.5	fℨij
	150			100.	10.	150	9.	
℥iij	180				12.	180	11.25	fℨiij
	200				13.	200	12.	
℥iv	240				16.	240	15.	fℨiv
℥v	300				20.	300	18.	fℨv
℥vj	360				24.	360	22.5	fℨvj
	400				26.	400	24.	
℥vij	420				28.	420	26.25	fℨvij
	450				30.	450	27.	
ℨj	480				32.	480	30.	fℨj

Equivalents.

Various methods have been proposed for adapting the metric weights to our apothecaries' weights used in prescription writing without entailing calculations in fractions. The method of taking 32 Grammes as equivalent to one troy ounce, and 30 Cc., or fluid Grammes, as equal to one fluidounce, seems to be the least objectionable. These equivalents are shown in the following:

32 Gm. = 1 ounce; 32 ÷ 8 = 4. Gm. = 1 drachm.
30 Cc. = 1 fluidounce; 30 ÷ 8 = 3.75 Cc. = 1 fluidrachm.

The exact metric equivalent of 1 grain is obtained by dividing the unit by the Gramme equivalent in grains; thus, 1. ÷ 15.432 = 0.0648 Gramme (or 6½ centigrammes).

The metric equivalents of all the other denominations may be obtained by multiplying the grain equivalent by the number of grains in one drachm; the number of drachms in a troy ounce, etc. The following exact Gramme equivalents are thus obtained:

1 grain.	1 drachm.	1 ounce av.	1 ounce troy.	1 ℔ troy.	1 ℔ av.
0.0648	3.888	28.349	31.103	373.250	453.592

To convert avoirdupois or troy into metric weights, the equivalent of the Gramme in grains—15.432—should be remembered, as it serves the purpose of a basis for obtaining the equivalent of all the higher denominations.

Table of Metric Equivalents

of Ounces (Apoth., Av., and Fluid) in Grammes and Cubic Centimeters.

Ounces, Apoth.,	℥	Grs.	Grammes, Gm. or G.	Fluidounces, f℥	Cubic centimeters, Cm. or Cc.	Exact equivalents.
	1		31	1	30	29.57
	2		62	2	60	59.15
	3		93	3	90	88.72
	3	103	100	3.38	100	
	4		124	4	120	118.3
	5		155	5	150	147.87
	6		186	6	180	177.44
	7		217	7	210	207.01
	8		248	8	240	236.59
	8	18	250	8.45	250	
	9		280	9	270	266.16
	10		311	10	300	295.73
	11		342	11	330	325.31
1 ℔	12		373	12	360	354.88
Av.	Ounces.	Grs.		1 pt. 16	480	473.18
1 ℔	16		453.6	17 1/11	500	
	17	278	500.	20	600	591.47
	20		566.8	24	720	709.77
	24		680.	2 pt. 32	960	946.35
	28		793.2	34 8/16	1000	
2 ℔	32		907.25	3 pt. 48	1440	1419.
	35	120	1000.	4 pt. 64	1920	1892.71
3 ℔	48		1360.	68 8/16	2000	
4 ℔	64		1814.5	5 pt. 80	2400	2365.9
	70	240	2000.	100	3000	2957.37
5 ℔	80		2268	1 gal. 128	3840	3785.43
	100		2835			
10 ℔	160		4536			

It will be noted that in the Pharmacopœia of 1890 the Gramme (Gm.) and the Cubic Centimeter (Cc.) are the only metrical terms used. The reason of this is simply that these two terms express sufficiently the quantities ordinarily handled, the remaining ones being excluded to avoid confusion, Grammes and Cubic Centimeters standing as perfect equivalents of ordinary weights and measures, as the foregoing tables indicate.

PHARMACEUTICAL PREPARATIONS.

PREPARATIONS made by the pharmacist are called *pharmaceutical* preparations. Nearly one-half of the articles of the United States Pharmacopœia are pharmaceutical; formulas being given for their preparation, they are intended to be made in the pharmacy. A still greater number are *unofficial*, being chiefly such as are made according to the formulas or prescriptions of eminent medical practitioners and teachers. Such of the latter as have attained general use and proved of value have been incorporated in the National Formulary, a work published under the direction of the American Pharmaceutical Association.

The importance of having a uniform standard for the preparation and strength of this class of medicines has long been recognized, instead of the variation in strength and product inseparable from a number of manufactures with the consequent multiplicity in processes and formulas. These preparations of the National Formulary, designated N. F., are included in this work, following the official preparations (U. S. P.) of the classes to which they belong.

The pharmaceutical preparations may be divided as follows:

I. Solutions.
II. Liquid Mixtures—Internal.
III. Extractive Preparations—Liquid and Solid.
IV. Mixtures of Solids—Internal.
V. Mixtures for External Use—Liquids and Solids.

These groups are each divided into a number of Classes, each class having a distinct Latin title by which its members, or individual preparations, are officially designated and alphabetically arranged in the U. S. P. In addition to the Latin and English titles, each class is also known by an English name, besides various synonyms. There are altogether 34 of these Classes official, besides a number unofficial.

	Official number.
I. The Solutions are divided, according to the character of the solvent, into—	
Aqueous: Aquæ—Waters	19
Liquores—Liquors (solutions proper)	24
Alcoholic: Spiritus—Spirits	25
Elixiria—Elixirs	2
Vina—Wines (by solution)	3

	Official number.
Saccharine: Syrupi—Syrups	32
Mellita—Honeys	2
Glycerin: Glycerita—Glycerites	6
II. The Liquid Mixtures—Internal:	
Misturæ—Mixtures (proper)	4
Emulsa—Emulsions	4
III. Extractive Preparations:	
Liquid:	
Aqueous: Mucilagines—Mucilages	4
Infusa—Infusions	4
Decocta—Decoctions	2
Acetous: Aceta—Vinegars	2
Vinous: Vina—Wines	5
Alcoholic: Tincturæ—Tinctures	71
Extracta Fluida—Fluid Extracts	89
Solid:	
Alcoholic: Extracta—Extracts	33
Abstracts (unofficial).	
Resinæ—Resins	3
Semi-liquid:	
Ethereal: Oleoresinæ—Oleoresins	6
IV. Mixtures of Solids—Internal:	
Pulveres—Powders	9
Trituratio—Trituration	1
Sales effervescentes—Salts, effervescent	4
Confectiones—Confections	2
Trochisci—Troches	15
Massæ—Masses	3
Pilulæ—Pills	15
V. Mixtures of Solids—External:	
Liquid: Linimenta—Liniments	9
Oleata—Oleates	3
Collodia—Collodions	4
Solid: Unguenta—Ointments	23
Cerata—Cerates	6
Suppositoria—Suppositories	1
Emplastra—Plasters	13
Chartæ—Papers	2
Total	453

AQUÆ MEDICATÆ—MEDICATED WATERS.

The Medicated Waters are solutions of volatile substances in Water. They comprise (1) the Aromatic Waters and (2) the Chemical Waters.

The *Aromatic Waters* are made by dissolving the volatile oils of their respective drugs, or distilling the latter with Water; two Waters are saturated solutions of other liquids than volatile oils—viz. Aqua Chloroformi and Aqua Creosoti.

The following are official:

Aqua—		*Contains Cc. in 100 Cc., or percentage by volume.*
Amygdalæ Amaræ	bitter almond oil	0.1
Anisi	anise oil	0.2
Aurantii Florum Fortior	saturated	
Aurantii Florum	of the above	50.
Camphoræ	camphor	0.8
Chloroformi[1]	chloroform	0.5
Cinnamomi	cinnamon oil	0.2
Creosoti	creosote	1.
Fœniculi	fennel oil	0.2
Menthæ Piperitæ	peppermint oil	0.2
Menthæ Viridis	spearmint oil	0.2
Rosæ Fortior	saturated	
Rosæ	of the above	50.

The *Chemical Waters* are solutions of gases in Water. The following are official:

Aqua—		*Contains gas, percentage by weight.*
Ammoniæ	NH_3	10
Ammoniæ Fortior	NH_3	28
Chlori	Cl	0.4
Hydrogenii Dioxidi (Hydrogen Peroxide)	H_2O_2	3.

LIQUORES—SOLUTIONS.

The Solutions (also termed *Solutio, -nes*, Lat.) are solutions of non-volatile substances in Water.

The official Solutions are all solutions of inorganic salts. They are made either by simple solution (dissolving the particular salt in

[1] Chloroform Water, aside from its medicinal properties, is an efficient preservative agent, and forms a good solvent in place of water for preparing solutions intended to be kept free from micro-organisms, as, for example, those for hypodermic use.

Water) or by chemical solution (reacting upon different substances, and obtaining the newly-formed salt in solution in the Water). The following 24 are official:

The *Arsenic Solutions:* these are all of the same strength—viz. 1 per cent.; 10 minims (0.6 Cc.) represent $\frac{1}{10}$ grain (0.006 Gm.) of arsenic, the usual dose:

Liquor—		*Percentage or Gm. in 100 Cc.*
Acidi Arsenosi	acid, arsenous	1.
Arseni et Hydrargyri Iodidi	arsenic iodide	1.
(Donovan's Solution).	mercuric iodide	1.
Potassii Arsenitis	potas. bicarb. 2; acid, arsenous	1.
(Fowler's Solution)	tinct. lavender comp.	3.
Sodii Arsenatis	sodium arsenate	1.

The *Alkaline Salt Solutions*, prepared by saturating an organic acid with an alkaline carbonate or bicarbonate, furnishing an agreeable and refreshing potion (also designated *Saturatio*, *Potio*, Lat.) charged with Carbonic Acid Gas. The *dose* is from 2 to 4 fluid-drachms (8–15 Cc.), except Liq. Magnesiæ Citratis:

Liquor—		*Gm. in 100 Cc.*
Ammonii Acetatis (Spiritus Mindererus)	ammon. carb.	5.
	acid. acetic. dil.	100.
Ferri et Ammonii Acetatis	liquor ammon. acet.	20.
(Basham's Mixture).	acid. acetic. dil. 3.; tr. ferri chlor.	2.
	elix. arom. 12; glycerin 10; aqua ad	100.
Magnesii Citratis	magnes. carb. 15.; acid. citric.	30.
	potas. bicarb. 25.; syrup.	
	acid. citric. 60 Cc.; aqua ad	350.
Potassii Citratis (Neutral Mixture)	potass. bicarb.	8.
	acid. citric. 6.; aqua ad	100.

The *Iron Solutions*, containing *ferric* salts in the following proportions by weight:

Liquor—		*Gm. in 100, or percentage by weight.*
Ferri Acetatis	ferric acetate	31.
Ferri Chloridi	ferric chloride	37.8
Ferri Citratis	ferric citrate	42.5
Ferri Nitratis	ferric nitrate	6.2
Ferri Subsulphatis (Monsel's)	ferric subsulphate	43.7
Ferri Tersulphatis	ferric sulphate	28.7

These are mostly used in producing other Iron preparations and compounds, particularly the Tincture of Ferric Chloride, the Ferric Hydrate (arsenical antidote), and the *scaled* salts of iron.

The *Alkali Solutions:*

Liquor—		*Percentage by vol. or weight.*
Calcis (Lime Water)	calcium hydrate	0.17
Potassæ	potassium hydrate	5.
Sodæ	sodium hydrate	5.
Sodæ Chloratæ (Labarraque's)	chlorine	2.6

The *Solutions of Metallic Compounds;* all but that of Iodine are used only externally:

Liquor—		*Percentage by vol. or weight.*
Iodi Compositus (Lugol's Solution)	potass. iodid.	10.
	iodine	5.
Hydrargyri Nitratis	mercuric nitrate	60.
Plumbi Subacetatis	lead subacetate	25.
Plumbi Subacetatis Dilutus	of above solution	3.
(Lead Water)	distilled water to	100.
Sodii Silicatis	sodium silicate	50.
Zinci Chloridi	zinc chloride	50.

Unofficial Liquors of the National Formulary.

Liquor—

ACIDI PHOSPHORICI COMPOSITUS (Acid Phosphates).

ALUMINI ACETATIS (Alumini Acetici, Ph. Ger.).—Contains 8 per cent. of basic Aluminum Acetate.

ALUMINI ACETICO-TARTRATIS.—Contains about 50 per cent. of dry, so-called Aluminum Acetico-tartrate, which may be obtained by evaporating the solution.

AURI ET ARSENI BROMIDI.—Ten minims contain $\frac{1}{32}$ grain (0.002 Gm.) of Tribromide of Gold and $\frac{1}{16}$ grain (0.004 Gm). of Tribromide of Arsenic.

BISMUTHI.—Each fluidrachm (4 Cc.) represents 1 grain (0.06 Gm.) Bismuth and Ammonium Citrate.

BROMI (Smith's Solution of Bromine).—Bromine, 20 per cent.; Potassium Bromide, 10 per cent.; Water.

CALCIS SULPHURATÆ (Solution of Oxysulphuret of Calcium; Vlemingkx's Solution or Lotion).

Liquor—

CUPRI ALKALINUS (Fehling's Solution).

I. *The Copper Solution.*

Copper Sulphate, pure	grains	505 . .	34,639 Gm.
Distilled Water . . enough to make	fluidounces	16 . .	500 Cc.

II. *The Alkaline Solution.*

Potassium and Sodium Tartrate . .	grains	252 . .	173 Gm.
Soda (U. S. P.)	troy ounces	2 . .	60 Gm.
Distilled Water . . enough to make	fluidounces	16 . .	500 Cc.

Keep both solutions, separately, in small well-stoppered vials, in a cool and dark place. For use, mix exactly equal volumes of both solutions by pouring the copper solution into the alkaline solution. Ten Cc. of the mixture prepared by metric weight and measure correspond to 0.05 Gm. of glucose. Of the mixture prepared by apothecaries' weight and measure, 210 minims correspond to 1 grain of glucose.

ELECTROPOEICUS (Battery-fluid).

A. *For the Carbon and Zinc Battery.*—I. (For ordinary use).—Potassium Bichromate, in powder, 6 troy ounces (180 Gm.); Sulphuric Acid, commercial, 6 fluidounces (180 Cc.); Water, cold, 48 fluidounces (1400 Cc.).—II. (For use with the galvano-cautery).—Sodium Bichromate, in powder, 6½ troy ounces (185 Gm.); Sulphuric Acid, commercial, 14 fluidounces (420 Cc.); Water, cold, 48 fluidounces (1400 Cc.).

Pour the Sulphuric Acid upon the powdered Bichromate and stir the mixture occasionally during one hour. Then slowly add the Water. Sodium Bichromate is more soluble than the Potassium Salt, and also much cheaper. When it cannot be obtained, the Potassium Salt may be substituted for it, weight for weight.

B. *For the Leclanché Battery.*—Ammonium Chloride, 6 troy ounces (180 Gm.); Water, enough to make 20 fluidounces (600 Cc.); dissolve the Salt in the Water.

FERRI OXYSULPHATIS (Oxysulphate of Iron).

FERRI PROTOCHLORIDI (Solution of Ferrous Chloride).—Each fluidrachm (4 Cc.) represents about 20 grains (1.3 Gm.) of Protochloride of Iron (ferrous chloride).

HYDRARGYRI ET POTASSII IODIDI (Solution of Iodide of Mercury and Potassium; Channing's Solution).—Red Mercuric Iodide, 72 grains (5.0 Gm.); Potassium Iodide, 56 grains (3.8 Gm.); in Distilled Water, 16 fluidounces (450 Cc.).

HYPOPHOSPHITUM.—Each fluidrachm (4 Cc.) contains 2 grains (0.12 Gm.) of Calcium Hypophosphite, 1¼ grains (0.75 Gm.) of Sodium Hypophosphite, and 1 grain (0.06 Gm.) of Potassium Hypophosphite.

IODI CARBOLATUS (Boulton's Solution; "French Mixture").—

Liquor—

Comp. Tincture of Iodine, 110 minims (7 Cc.); Carbolic Acid, 40 grains (3.0 Gm.); Glycerin, 2½ fluidounces (100.0 Cc.); in 16 fluidounces (450 Cc.).

IODI CAUSTICUS (Iodine Caustic; Churchill's Iodine Caustic).—Iodine, 1 troy ounce (31 Gm.); Potassium Iodide, 2 troy ounces (63 Gm.); in Water, 4 fluidounces (120 Cc.).

MAGNESII BROMIDI.—Each fluidounce (30 Cc.) contains about 7 grains (0.5 Gm.) of Magnesium Bromide.

MORPHINÆ CITRATIS.—Each fluidrachm (4 Cc.) contains 2 grains (0.12 Gm.) of Morphine in the form of citrate.

MORPHINÆ HYPODERMICUS (Magendie's Solution of Morphine).[1]—16 grains (1 Gm.) Morphine Sulphate to 1 fluidounce (30 Cc.).

PANCREATICUS (Pancreatic Solution).—Each fluidrachm (4 Cc.) represents 1 grain (0.06 Gm.) of Pancreatin, effectually preserved in Glycerin and a little Alcohol.

PEPSINI AROMATICUS.—Each fluidrachm (4 Cc.) represents 1 grain (0.06 Gm.) of Pepsin.

PHOSPHORI (Thompson's Solution of Phosphorus).—Each fluidrachm (4 Cc.) contains about $\frac{1}{24}$ grain (0.0025 Gm.) of Phosphorus, preserved in Absolute Alcohol and Glycerin.

PICIS ALKALINUS (Tar, Alkaline).

POTASSÆ CHLORATÆ (Solution of Chlorinated Potassa; Javelle Water).—An effective and popular disinfectant.

POTASSII ARSENATIS ET BROMIDI (Liquor Arsenii Bromidi; Clemens' Solution).—This solution contains an amount of Arsenic in combination corresponding to about 1 per cent. of Arsenous Acid.

The title "Solution of Bromide of Arsenic" (Liquor Arsenii Bromidi), which is often applied to Clemens' Solution or similar preparation, is a misnomer, since bromide of arsenic cannot exist, as such, in presence of water, but is split up into hydrobromic and arsenous acids. The proportions of the ingredients, in the formula above given, have been adjusted as closely as practicable, so as to yield definite compounds—viz. arsenate and bromide of potassium.

SACCHARINI (Solution of Saccharin).—Each fluidrachm represents 4 grains of Saccharin.

Intended to be used for sweetening liquids and solids when the use of sugar is objectionable, or when a sweet taste is to be imparted to a liquid without increasing its density.

[1] Particular care should be taken in prescribing and dispensing this solution, so that it may not be mistaken for the so-called United States Solution of Morphine (Liquor Morphiæ Sulphatis, U. S. P. 1870), containing only 1 grain of Sulphate of Morphine in each fluidounce, which is still occasionally used.

Liquor—

SERIPARUS (Liquid Rennet).

If this liquid is to be used merely for curdling milk, without separating the whey as a distinct layer, it should be added to the milk, previously warmed to a temperature of about 35° C. (95° F.), and the mixture should then be set aside undisturbed until it coagulates. If the whey is to be separated, the Liquid Rennet should be added to the milk while cold, and the mixture heated to about 35° C. (95° F.), but not exceeding 40° C. (104° F.). One part of the liquid should coagulate between 200 and 300 parts of cows' milk.

LIQUOR SODII ARSENATIS, PEARSON.—This Solution contains about $\frac{1}{10}$ per cent. of anhydrous Sodium Arsenate.

This preparation should not be confounded with the Liquor Sodii Arsenatis of the U. S. P., which is ten times stronger than the above. Pearson's Solution is official in the French Pharmacopœia, under the title Solute d'Arseniate de Soude (or Solution Arsenicale de Pearson).

SODII BORATIS COMPOSITUS (Dobell's Solution).—Sodium Borate and Sodium Bicarbonate, each 120 grains (8.0 Gm.); Carbolic Acid, 24 grains (1.5 Gm.); Glycerin, $\frac{1}{2}$ fluidounce (15 Cc.); in Water, 16 fluidounces (450 Cc.).

SODII CARBOLATIS (Phénol Sodique).—Carbolic Acid, 50 per cent.; Soda, 3 per cent.; in Water.

SODII CITRATIS.—Saturatio (Potio Riveri, Ph. Ger.).—Citric Acid, 150 grains (10.0 Gm.); Sodium Bicarbonate, 190 grains (12.5 Gm.); in Water, 16 fluidounces (450 Cc.).

SODII CITRO-TARTRATIS (Effervescing Saline Water).—Sodium Bicarbonate, Tartaric Acid, Citric Acid, Syrup, and Water, in about the same proportions as in Solution of Magnesium Citrate, for which it is a cheaper substitute.

SODII OLEATIS (Oleate of Sodium).—Intended to be used in the preparation of oleates.

STRYCHNINÆ ACETATIS (Hall's Solution of Strychnine).—Each fluidrachm (4 Cc.) contains $\frac{1}{8}$ grain (0.008 Gm.) Strychnine Acetate.

The Ph. Br. directs a Liquor Strychninæ Hydrochloratis (with synonym, Liquor Strychniæ) which is much stronger, and should not be confounded with the above preparation. It should never be dispensed unless expressly designated.

ZINCI ET FERRI COMPOSITUS (Deodorant Solution).—A combination of Sulphates of Zinc and Iron, Naphthol, Oil of Thyme, and Hypophosphorous Acid, in Water.

Used as a simple deodorant and antiseptic for common domestic use when it is unnecessary or impracticable to employ more powerful agents.

When a deodorant solution is required for purposes where iron is objectionable—as, for instance, when woven fabrics are to be steeped in it—the following preparation may be employed:

Liquor Zinci et Alumini Compositus, in which the Iron Sulphate is replaced by Aluminum Sulphate.

Liquor—

ZINGIBERIS (Essence of Ginger).—A 25 per cent. preparation of Ginger for flavoring aqueous mixtures.

SPIRITUS—SPIRITS.

The Spirits are solutions of volatile substances in Alcohol. They comprise (1) the Natural Spirits; (2) the Aromatic Spirits, or so-called "Essences;" and (3) the Medicinal Spirits.

The *Natural Spirits* are produced by distillation, and include:

Spiritus Frumenti (Whiskey), containing Alcohol 50–58 per cent. by volume.

Spiritus Vini Gallici (Brandy), containing Alcohol 46–55 per cent. by volume.

Spiritus Juniperi Comp. (Gin), containing Alcohol 60–70 per cent. by volume.

The *Aromatic Spirits* are made by dissolving the respective oils or aromatic principles in (deodorized) Alcohol:

Spiritus—		*Cc. in 100 Cc., or percentage by vol.*
Amygdalæ Amaræ (water 20)	bitter almond oil	1.
Anisi (alcohol deod.)	anise oil	10.
Aurantii " "	orange oil	5.
Aurantii Comp. (alcohol deod.)	orange oil	20.
	oils, anise 0.5, coriander 2; lemon oil	5.
Camphoræ	camphor	10.
Cinnamomi	cinnamon oil	10.
Gaultheriæ	wintergreen oil	5.
Juniperi	juniper oil	5.
Lavandulæ (alcohol deod.)	lavender oil	5.
Limonis	lemon peel 5; oil	5.
Menthæ Piperitæ	peppermint herb 1; oil	10.
Menthæ Viridis	spearmint herb 1; oil	10.
Myrciæ (Bay Rum)	water 38; oil of bay	0.8
	oils, orange, pimenta, each	0.05
Myristicæ	nutmeg (vol.) oil	5.

These are chiefly used for flavoring purposes; some are used

medicinally as aromatic stimulants and carminatives in doses of from 15–30 minims (1–2 Cc.); Spiritus Amygdalæ Amaræ contains Hydrocyanic Acid, and is never used internally except in very small quantities as a flavor.

The *Medicinal Spirits* are made by solutions of the medicinal substance in Alcohol.

The following are official:

Spiritus—		*Cc. in 100 Cc., or percentage by vol.*
Ætheris	ether $(C_2H_5)_2O$	32.5
Ætheris Comp. (Hoffmann's Anodyne)	ethereal oil	2.5
	ether	32.5
		By weight.
Ætheris Nitrosi (Sweet Spirit of Nitre)	ethyl nitrite	4.
Ammoniæ	ammonia gas	10.
Ammoniæ Aromaticus	water 14; ammonia water	9.
	ammonia carb.	3.4
	oils, lavender, nutmeg, each 0.1; lemon oil	1.
Chloroformi	chloroform	6.
Glonoini	nitroglycerin	1.
Phosphori	absolute alcohol, phosphorus	0.12

The *dose* of these Spirits is from 30 to 60 minims (2 to 4 Cc.; about 75 to 150 "drops"), except the Ammonia Spirit, used only in the preparation of Liniments (externally), and that of Phosphorus, which is for the preparation of the Elixir.

Unofficial Spirits of the National Formulary.

Spiritus—

ACIDI FORMICI (Spirit of Ants, Ph. Ger.).—A solution of 3 per cent. of Formic Acid in Water and Alcohol.

OPHTHALMICUS (Alcoholic Eye-wash).—A solution of 10 minims (0.6 Cc.) Oil of Lavender and 30 minims (2 Cc.) Oil of Rosemary, in Alcohol 1 fluidounce (30 Cc.).

SAPONATUS (Spirit of Soap).

SINAPIS (Spirit of Mustard, Ph. Ger.).—A solution of 2½ per cent. of Volatile Oil of Mustard in Alcohol.

SYRUPI—SYRUPS.

Syrups are nearly *saturated* Solutions of Sugar in Water, in which aromatic or medicinal substances are dissolved.

The official Syrup, *Syrupus*, contains 65 per cent. by weight, 85 per cent. by volume, of Sugar (about 7 pounds, average, in 1 gallon): with a smaller proportion of Sugar the syrup undergoes fermentation (spoils).

The "Medicated Syrups" contain less sugar, owing to the solution of the medicinal substances, which usually reduce the solubility of the sugar in the liquid from which the syrup is prepared. Syrups should be kept in a *cool* place, in cork-stoppered bottles, in order to *preserve* them.

The thirty-two official Syrups are made by different methods: by solution, or mixing the medicinal substance with the syrup; by dissolving the Sugar in the medicinal solution; by extraction from the drug; and by chemical reaction and solution.

They may be divided into (1) the aromatic or adjuvant syrups, and (2) the medicinal syrups, comprising (*a*) those made from extractive drugs, including alteratives, astringents, cathartics, and expectorants, and (*b*) those made from chemicals, either by simple solution or by chemical reaction and solution, including the hypophosphites, iron, and other tonics.

The *Aromatic* or *Adjuvant Syrups* are mostly used as additions to, or vehicles of, liquid mixtures containing Bromides, Iodides, Phosphates, or similar salts of disagreeable saline taste, desirable to disguise.

The following are official:

Syrupus—		*Cc. in 100 Cc., or percentage by vol.*
Acaciæ	mucilage acacia	25.
Acidi Citrici	spir. lemon, 1; acid, citric	1.
Althææ	marshmallow	5.
Amygdalæ	(bitter almond 4, sweet almond 14)	18.
	orange flower water	10.
Aurantii	orange, fresh exterior rind	5.
Aurantii Florum	orange flower water	50.
Rubi Idæi	raspberry juice (fresh)	40.
Tolutanus	tolu balsam	1.
Zingiberis	fluid extract of ginger	3.

The *Extractive Syrups* are often made by mixing the Fluid Extract of the respective drugs with Syrup.

Tinctures and Fluid Extracts of *resinous* drugs often precipitate

when mixed with Syrups and aqueous solutions. In order to furnish clear mixtures it is therefore sometimes necessary to mix the extractive preparation with Water, clarify the mixture by filtration, and dissolve the sugar in the filtered liquid.

The following are official:

Syrupus—		*Gm. of Drug in 100 Cc.*
Allii	vinegar of garlic	20.
Ipecacuanhæ	fl. ext. ipecac	7.
Krameriæ	fl. ext. rhatany	45.
Lactucarii	tinct. lactucarium	10.
Picis Liquidæ	glycerite, tar	7.5
Pruni Virginianæ	wild cherry	15.
Rhei	fl. ext. rhubarb	10.
Rhei Aromaticus	tinct. rhubarb, arom.	15.
Rosæ	fl. ext. red rose	12.5
Rubi	fl. ext. blackberry bark	25.
Sarsaparillæ Comp.	fl. ext. sarsaparilla	20.
	fl. ext. glycyrrh., senna, each	1.5
	oils, sassafras, anise, gaultheria, each	0.01
Scillæ	vinegar of squill	45.
Scillæ Comp.	fl. exts. squill, senega, each	8.
(Coxe's Hive Syrup)	antimony and potass. tart.	0.2
Senegæ	fl. ext. senega	20.
Sennæ	oil coriander 0.5; senna	25.

The *Chemical Syrups* are an elegant class of preparations in which the taste of the medicinal agents is greatly modified. They do not keep well unless put up in small bottles completely filled, ready for dispensing. Except the Syrup of Iodide of Iron, which is best preserved in bottles exposed to light, they should be kept in a *cool* and *dark* place.

The Syrup of Iron, Quinine, and Strychnine Phosphates (Easton's Syrup, Ph. Br.) is almost identical with the well-known unofficial Elixir of that name. It contains $\frac{1}{60}$ grain of Strychnine in 80 minims (1 mg. in 5 Cc.); the formula of the U. S. P. 1880 yielding a Syrup nearly three times as strong, care should be observed that the preparations of the two formulas be not accidentally confused with each other. A somewhat similar preparation is the Syrupus Hypophosphitum Compositus of the N. F.

The following are official:

	Percentage, Gm. or Cc. in 100.
Syrupus—	
Acidi Hydriodici . . . . . acid, hydriodic, by weight	1.
Calcii Lactophosphatis . . . calcium lactophosphate	1.
Calcis . . . . . lime (calcium saccharate)	1.
Ferri Iodidi . . . . . ferrous iodide, by weight	10.

	Grains in 1 fluidrachm (4 Cc.).	*Percentage by vol.*
Ferri, Quininæ et Strychninæ Phosphatum:		
ferric phosphate, soluble	1½	2.
quinine sulphate	2	3.
strychnine	1/90	0.02
acid, phosphoric	3	4.8
Hypophosphitum . . . calcium hypophosphite	3	4.5
potassium and sodium hypophosphites, each	1	1.5
spirit lemon 0.5; acid hypophos. dil.		0.2
Hypophosphitum cum Ferro . . ferrous lactate with potass. citrate 1, in syrup hypophosph.		1.

Unofficial Syrups of the National Formulary.

Unless otherwise stated, the *dose* is 1 to 2 fluidrachms or teaspoonfuls (4–8 Cc.).

Syrupus—

ACTÆÆ COMPOSITUS (Cimicifuga or Black Cohosh).—Containing 2½ grains (0.15) each of Cimicifuga and Wild Cherry, 1¼ grains (0.07) Glycyrrhiza and Senega, and ⅝ grain (0.04) Ipecac in each fluidrachm (4 Cc.).

ASARI COMPOSITUS (Canada Snake Root).—Each fluidrachm (4 Cc.) represents 3½ grains (0.2) of Asarum.

CALCII CHLORHYDROPHOSPHATIS (Chlorhydrophosphate of Lime).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Calcium Phosphate.

CALCII ET SODII HYPOPHOSPHITUM (Hypophosphite of Lime and Soda).—Each fluidrachm (4 Cc.) contains 2 grains (0.13), each, of Hypophosphites of Calcium and Sodium.

CALCII HYPOPHOSPHITIS (Hypophosphite of Lime).—Each fluidrachm (4 Cc.) contains 2 grains (0.13) of Calcium Hypophosphite.

CALCII IODIDI (Iodide of Calcium).—Each fluidrachm (4 Cc.) contains about 5 grains (0.3) of Calcium Iodide.

Syrupus—

CALCII LACTOPHOSPHATIS CUM FERRO (Lactophosphate of Lime with Iron).—Each fluidrachm (4 Cc.) contains ½ grain (0.03) of Lactate of Iron and about ¼ grain (0.015) of Calcium Lactate (or about ⅜ grain (0.02) of so-called Lactophosphate of Calcium).

CHONDRI COMPOSITUS (Irish Moss).—Containing 1 grain (0.06) each of Squill and Senega, $\frac{1}{16}$ grain (0.004) each of Ipecac and Irish Moss, and $1\frac{2}{3}$ minims (0.1) Tincture Opium Camph. to each fluidrachm (4 Cc.).

CINNAMOMI (Cinnamon, Ph. Ger.).—Chiefly used for flavoring.

CODEINÆ.—Containing ½ grain (0.03) Codeine Sulphate in each fluidrachm (4 Cc.). The Syrup of the French Codex is about one-fourth this strength.

COFFEÆ (Coffee).—Containing 15 grains (1.) of the choicest Coffee (Java and Mocha) in fluidrachm (4 Cc.); an elegant vehicle for Quinine and addition to nauseous mixtures.

ERIODICTYI AROMATICUS (Yerba Santa; Syrupus Corrigens).—Chiefly intended as a vehicle for disguising the taste of Quinine and other bitter substances.

FERRI ARSENATIS.—Each fluidrachm (4 Cc.) contains about $\frac{1}{60}$ grain (0.001) of Arsenate of Iron (ferric).

FERRI BROMIDI (U. S. P., '80).—Containing 10 per cent. of Ferrous Bromide.

FERRI CITRO-IODIDI (Tasteless Syrup of Iodide of Iron).—Each fluidrachm (4 Cc.) contains an amount of Iron corresponding to about 3.6 grains (0.25) of Ferric Iodide. The official Syrupus Ferri Iodidi contains about 8 grains (0.5) of Ferrous Iodide (Protiodide of Iron) in each fluidrachm (4 Cc.).

FERRI ET MANGANI IODIDI (Iodide of Iron and Manganese).—Each fluidrachm (4 Cc.) contains 6 grains (0.4) of Iodide of Iron (ferrous) and 3 grains (0.2) of Iodide of Manganese.

FERRI HYPOPHOSPHITIS (Hypophosphite of Iron).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Hypophosphite of Iron (ferric).

FERRI LACTOPHOSPHATIS (Lactophosphate of Iron).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Lactate of Iron, or about 1½ grains (0.1) of so-called Lactophosphate of Iron.

FERRI PROTOCHLORIDI (Ferrous Chloride).—Each fluidrachm

Syrupus—

(4 Cc.) contains about 1 grain (0.06) of Protochloride of Iron.

FERRI SACCHARATI SOLUBILIS (Soluble Saccharated Iron; Saccharated Oxide of Iron, Ph. Ger.).—Each 75 minims (5 Cc.) represents approximately 1 grain (0.06) of Metallic Iron, or 3 grains (0.2) of Oxide of Iron.

GLYCYRRHIZÆ (Liquorice).—Each fluidrachm (4 Cc.) represents 30 grains (2.) of Glycyrrhiza.

HYPOPHOSPHITUM COMPOSITUS.—Each fluidrachm (4 Cc.) contains 2 grains (0.12) of Calcium Hypophosphite, 1 grain (0.06), each, of the Hypophosphites of Potassium and Sodium, $\frac{1}{8}$ grain (0.008), each, of the Hypophosphites of Iron and Manganese, $\frac{1}{16}$ grain (0.004) of Quinine Hydrochlorate, and $1\frac{1}{4}$ minims (0.01) of Tincture of Nux Vomica.

This Syrup should not be confounded with the official Syrupus Hypophosphitum (Syrup of the Hypophosphites: Calcium, Sodium, and Potassium). It is intended to replace a well-known proprietary article, for which it has been found by many physicians to be a satisfactory substitute. It is uniform in composition and more stable and elegant than the patent article.

IPECACUANHÆ ET OPII (Syrup of Dover's Powder).—Each fluidrachm (4 Cc.) represents 5 grains (0.3) of Dover's Powder, or $\frac{1}{2}$ grain (0.03), each, of Ipecac and Opium.

MANNÆ (Syrup of Manna, Ph. Ger.).

MORPHINÆ COMPOSITUS.—A preparation sometimes dispensed as Jackson's Pectoral Syrup, but, as it differs in essential particulars, the N. F. recommends that this preparation be dispensed only when expressly designated under this title. Each fluidrachm (4 Cc.) contains $\frac{1}{8}$ grain (0.008) Ipecac, 5 grains (0.3) Senega, 1 grain (0.06) Rhubarb, and $\frac{1}{32}$ grain (0.002) Morphine, with Oil of Sassafras.

MORPHINÆ SULPHATIS (Syrup of Morphine).—Each fluidrachm (4 Cc.) contains $\frac{1}{8}$ grain (0.008) of Sulphate of Morphine.

PAPAVERIS (Poppy, Ph. Br.; Diacodii, Ph. Ger.).—Similar to the preceding, but considerably weaker.

PECTORALIS (Jackson's Pectoral Syrup).—Each fluidrachm (4 Cc.) contains $\frac{1}{32}$ grain (0.002), each, of Morphine and Oil of Sassafras.

PHOSPHATUM COMPOSITUS (Chemical Food).—Each fluidrachm (4 Cc.) contains about 2 grains (0.12) of Phosphate of

Syrupus—

Calcium, 1 grain (0.06), each, of the Phosphates of Iron and Ammonium, and smaller quantities of the Phosphates of Potassium and Sodium.

PINI STROBI COMPOSITUS (White Pine Compound).—A combination of White Pine, Wild Cherry, Spikenard, Sanguinaria, Chloroform, and Morphine, $\frac{1}{32}$ grain (0.002) in a fluidrachm.

RHAMNI CATHARTICÆ (Buckthorn Berries; Syrupus Spinæ Cervinæ, Ph. Ger.).

RUBI AROMATICUS (Blackberry, Aromatic).—A combination of Rubus, Cinnamon, Nutmeg, Cloves, and Allspice.

SANGUINARIÆ (Bloodroot).—Each fluidrachm (4 Cc.) represents 13 grains (0.8) of Sanguinaria.

SENNÆ AROMATICUS (Senna, Aromatic).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) of Senna, 3 grains (0.2) of Jalap, and 1 grain (0.06) of Rhubarb, with aromatics.

SENNÆ COMPOSITUS (Senna, Compound).—Each fluidrachm (4 Cc.) represents 8 grains (0.5) of Senna, 2 grains (0.12), each, of Rhubarb and Frangula.

SODII HYPOPHOSPHITIS.—Each fluidrachm (4 Cc.) contains 2 grains (0.12) of Sodium Hypophosphite.

STILLINGIÆ COMPOSITUS.—Each fluidrachm (4 Cc.) represents 15 minims (1 Cc.) of Compound Fluid Extract of Stillingia.

OXYMEL SCILLÆ (Oxymel of Squill, Ph. Br.).—A preparation of Honey containing about 5 grains (.32 Gm.) of Squill in each fluidrachm (4 Cc.).

ELIXIRIA—ELIXIRS.

Elixirs are a class of elegant preparations similar to wines or cordials, composed of Water, Sugar, Alcohol, and Aromatics.

The medicinal substances are usually in such proportion that an ordinary dose may be contained in one or two teaspoonfuls (4 to 8 Cc.) of the elixir.

There are but two Elixirs official: Aromatic Elixir, which serves as a vehicle, and one medicinal, Elixir of Phosphorus.

Elixir Aromaticum	spirit of orange, comp.	12 Cc.
mix with	alcohol, deodorized, to make	250 Cc.
to this solution add in several portions, agitating after each addition	syrup	375 Cc.
and in the same manner	water	375 Cc.

mix the liquid with precipitated calcium phosphate 15 Gm.
and filter, adding . . water 3; alcohol 1; to make 1000 Cc.

This illustrates the method by which Elixirs are made. The medicinal ingredients are dissolved in the Water, or Alcohol, as indicated by their solubilities, before mixing the Alcoholic Solution of Oils with the Saccharine Solution.

Elixir Phosphori: glyc. 55; anise oil 0.2; sp. phosph. 21 Cc.
mix by agitation; then add . aromatic elixir, to 100 Cc.

This Elixir contains of phosphorus 25 mg. in 100 Cc., or $\frac{1}{65}$ grain (1 mg.) in 1 fluidrachm (4 Cc.), the ordinary dose.

Some Salts and Fluid Extracts may be dissolved in or mixed with the Elixir itself. For example:

Potassii Bromidi . . . . . 10.
Elixir Aromatici . . . . . q. s. ad 100. Cc.

This contains 15 grains (1 Gm.) in $2\frac{1}{2}$ fluidrachms (10 Cc.), 6 grains in 1 fluidrachm or teaspoonful.

Elixirs of the National Formulary.

The value of pleasant vehicles to mask or modify the taste of bitter and nauseous drugs is recognized by every prescriber. The following Elixirs of the National Formulary have been carefully selected, and embrace the most effective combinations of adjuvants and aromatics for disguising the different drugs for which they are recommended:

Elixir—

ANISI; a combination of Anethol, Fennel, and Bitter Almond.
CURASSAO (Curaçao Cordial); a combination of Curaçao, Orris, and a little Citric Acid.

Adjuvant Elixirs.—The following are intended as vehicles for Quinine and similar bitter substances, and as adjuvants for Tinctures and Fluid Extracts of bitter and resinous drugs, such as Cinchona, Cascara Sagrada, etc. They all contain Glycyrrhiza, which, in the form directed in the N. F. (Russian Licorice Root, peeled), is most effective in masking the bitter taste of Quinine, when it is directed to be simply suspended in the mixture without the use of acid for effecting solution. Acids precipitate the glycyrrhizin and destroy its power of masking the bitter taste:

Elixir—

ADJUVANS; a combination of Orange, Wild Cherry, Glycyrrhiza, Coriander, and Caraway.

Except for the exhibition of Quinine this is the most effective of the adjuvant Elixirs.

Elixir—

ERIODICTYI AROMATICUM (Arom. Elixir Yerba Santa; Elixir Corrigens).—A solution of Yerba Santa in Comp. Elixir of Taraxacum, intended as a vehicle for Quinine and other bitter remedies.

GLYCYRRHIZÆ (Elixir of Licorice); a solution of Licorice in Aromatic Elixir, the most effective vehicle for Quinine.

GLYCYRRHIZÆ AROMATICUM; Elixir of Licorice, with the addition of strong aromatics.

TARAXACI COMPOSITUM; an improved form of this well-known compound, useful as a mild adjuvant.

Medicinal Elixirs.—These comprise the Elixirs mostly in use; also, a number of preparations in which the prescriber will find satisfactory substitutes, designated by scientific titles and of definite strength and uniform composition, intended to replace various nostrums.

	Active Drug in	
	1 Fluidrachm.	*4 Cc.*
Elixir—	*grains.*	*Gm.*
ACIDI SALICYLICI	5	0.3
AMMONII BROMIDI	5	0.3
AMMONII VALERIANATIS	2	0.12
The odor and taste of the salt being well covered by the addition of vanilla and a little chloroform.		
AMMONII VALERIANATIS ET QUININÆ.—The above, with Quinine Hydrochlorate	¼	0.015
APII GRAVEOLENTIS (Celery Compound).—Containing Celery, Coca, Kola, and Viburnum, each	4	0.25
BISMUTHI.—Bismuth and Ammonium Citrate	2	0.12
BUCHU	7½	0.5
BUCHU COMPOSITUM.—Buchu, Cubeb, Juniper, and Uva Ursi, combined	15	1.
BUCHU ET POTASSII ACETATIS.—Elixir Buchu, with Potassium Acetate	5	0.3
CAFFEINÆ.—Caffeine (in solution in Hydrobromic Acid)	1	0.06
CALCII BROMIDI	5	0.3
CALCII HYPOPHOSPHITIS	2	.12

	Active Drug in 1 *Fluidrachm.* Grains.	4 *Cc.* Gm.
Elixir—		
CALCII LACTOPHOSPHATIS.—Calcium Lactate (in Phosphoric Acid)	1	0.06
CATHARTICUM COMPOSITUM.—Each fluidrachm (4 Cc.) contains Senna 7½ grains (0.5); Podophyllum 4 grains (0.25); Leptandra and Jalap, each 3 grains (0.2); Rochelle Salts 7½ grains (0.5); and Sodium Bicarbonate 1 grain (0.06). The mixture should be shaken.		
CHLOROFORMI COMPOSITUM.—A mixture of equal parts of Chloroform, Tincture of Opium, Spirit of Camphor, Aromatic Spirit of Ammonia, and Alcohol, flavored with Cinnamon. The old title, "Chloroform Paregoric," is recommended to be abandoned for the above. Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Opium and 11 minims (0.7) of Chloroform.		
CINCHONÆ (Elixir Calisaya).—This preparation is from the best Calisaya Bark, representing about 2 grains (0.12) in each fluidrachm (4 Cc.). It is preferable to preparations made from Quinine and the cheaper alkaloids in being a more agreeable and effective antiperiodic tonic.		
CINCHONÆ ET FERRI (Calisaya and Iron; Ferrated Elixir of Calisaya).—Phosphate of Iron .	2	0.12
CINCHONÆ ET HYPOPHOSPHITUM.—Calcium and Sodium Hypophosphites, each	1	0.06
CINCHONÆ, FERRI, BISMUTHI ET STRYCHNINÆ. —Phosphate of Iron	2	0.12
Bismuth and Ammonium Citrate	1	0.06
Strychnine Sulphate	$\frac{1}{100}$	0.0007
CINCHONÆ, FERRI ET BISMUTHI.—Phosphate of Iron	2	0.12
Bismuth and Ammonium Citrate	1	0.06
CINCHONÆ, FERRI ET CALCII LACTOPHOSPHATIS. —Phosphate of Iron	1½	0.1
Calcium Lactophosphate . . . . . about	1	0.06

Elixir—	*Active Drug in 1 Fluidrachm.* Grains.	*4 Cc.* Gm.
CINCHONÆ, FERRI ET PEPSINI.—Phosphate of Iron	1½	0.1
Pepsin	1	0.06
CINCHONÆ, FERRI ET STRYCHNINÆ.—Phosphate of Iron	2	0.12
Sulphate of Strychnine	$\frac{1}{100}$	0.0007
CINCHONÆ, PEPSINI ET STRYCHNINÆ.—Containing smaller quantities of the Cinchona Alkaloids, Pepsin 1 grain (0.06), and Sulphate of Strychnine	$\frac{1}{100}$	0.0007
COCÆ (Coca).—Leaves, Erythroxylon Coca	7½	0.5
COCÆ ET GUARANÆ.—Coca and Guarana, of each	7½	0.5
CORYDALIS COMPOSITUM.—Containing of Corydalis, Stillingia, Iris, and Xanthoxylum, combined	15	1.
Potassium Iodide	3	0.2
DIGESTIVUM COMPOSITUM.—Containing about 5 grains (0.3) of Pulvis Digestivus in each fluidrachm (4 Cc.).		
EUCALYPTI.—Eucalyptus Globulus	7½	0.5
EUONYMI (Wahoo).—Euonymus Atropurpureus	10	0.6
FERRI HYPOPHOSPHITIS.—Hypophosphite of Iron (ferric)	1	00.6
FERRI LACTATIS	1	0.06
FERRI PHOSPHATIS.—Phosphate of Iron (U.S.P.)	2	0.12
FERRI PHOSPHATIS, CINCHONIDINÆ ET STRYCHNINÆ.—Phosphate of Iron	2	0.12
Cinchonidine	½	0.03
Sulphate of Strychnine	$\frac{1}{100}$	0.0007
FERRI PHOSPHATIS, QUININÆ ET STRYCHNINÆ.—Phosphate of Iron, 1 grain (0.06); Quinine	½	0.03
Sulphate of Strychnine	$\frac{1}{64}$	0.001
FERRI PYROPHOSPHATIS	2	0.12
FERRI, QUININÆ ET STRYCHNINÆ.—Ferric Chloride, 1 grain (0.06); Quinine Hydrochlorate	½	0.03
Sulphate of Strychnine	$\frac{1}{100}$	0.0007
FRANGULÆ (Buckthorn).—Rhamnus Frangula	15	1.

Elixir—	*Active Drug in* 1 *Fluidrachm.* Grains.	4 *Cc.* Gm.
GENTIANÆ	2	0.12
GENTIANÆ CUM TINCTURA FERRI CHLORIDI.—Tincture Citro-chloride of Iron	5	0.3
GENTIANÆ ET FERRI PHOSPHATIS (ferrophosphated).—Phosphate of Iron	1	0.06
GRINDELIÆ.—Grindelia Robusta	4	0.25
GUARANÆ.—Paullinia Cupana	12	0.75
HUMULI	7½	0.5
HYPOPHOSPHITUM.—Calcium Hypophosphite	3	0.2
Sodium and Potassium Hypophosphites, each	1	0.06
HYPOPHOSPHITUM CUM FERRO.—Calcium and Sodium Hypophosphite, each	1	0.06
Potassium and Iron Hypophosphites, each	½	0.03
LITHII BROMIDI	5	0.3
LITHII CITRATIS	5	0.3
LITHII SALICYLATIS	5	0.3
MALTI ET FERRI.—Phosphate of Iron	1	0.06
Malt Extract	15	1.
PARALDEHYDI.—Paraldehyde	15	1.
PEPSINI.—Pepsin	1	0.06
PEPSINI, BISMUTHI ET STRYCHNINÆ.—Elixir Pepsin and Bismuth, and Strychnine	$\frac{1}{100}$	0.0007
PEPSINI ET BISMUTHI.—Pepsin	1	0.06
Bismuth and Ammonium Citrate	2	0.12
PEPSINI ET FERRI.—Elixir of Pepsin and Tincture Citro-chloride of Iron	5.	0.3
PHOSPHORI ET NUCIS VOMICÆ.—Elixir Phosphorus, with Tincture Nux Vomica	2	0.12
PICIS COMPOSITUM.—A combination of Prunus Virginiana, Tolu, Methylic Alcohol, and Sulphate of Morphine	$\frac{1}{60}$	0.0015
PILOCARPI (Jaborandi).—Pilocarpus Selloanus	4	0.25
POTASSII ACETATIS	5	0.3
POTASSII ACETATIS ET JUNIPERI.—Elixir Potass. Acet. with Juniper	7½	0.5
POTASSII BROMIDI.—Potassium Bromide, effectually masked in Adjuvant Elixir	10	0.6

An Elixir half this strength has also been used.

Elixir—	*Active Drug in 1 Fluidrachm.* Grains.	*4 Cc.* Gm.
QUININÆ COMPOSITUM (Red).—Sulphates of Quinine, ⅛ grain (0.008), Cinchonidine and Cinchonine, each	1/16	0.004
Chiefly intended as a substitue for Elixir Cinchona when the administration of other constituents of the bark may be deemed objectionable.		
QUININÆ ET PHOSPHATUM COMPOSITUM.—Quinine Sulphate	¼	0.015
Phosphate of Iron	1	0.06
Calcium Lactophosphate	¾	0.05
QUININÆ VALERIANATIS ET STRYCHNINÆ.—Valerianate of Quinine	1	0.06
Sulphate of Strychnine	1/100	0.0007
RHAMNI PURSHIANÆ (Cascara Sagrada).—Rhamnus Purshiana, its bitterness effectually masked with Elixirs of Glycyrrhiza and Taraxacum Compound	15	1.
RHAMNI PURSHIANÆ COMPOSITUM (Laxative Elixir; Elixir Purgans).—Cascara Sagrada	7½	0.5
Senna and Juglans, each	5	0.3
Associated with aromatics and correctives; a most effective laxative in doses of from 1 to 2 fluidrachms (4–8 Cc.).		
RHEI.—Sweet Tincture of Rhubarb, representing Rhubarb	2½	0.15
RHEI ET MAGNESIÆ ACETATIS.—Magnesium Acetate, 4 grains (0.25); Rhubarb	7½	0.5
RUBI COMPOSITUM (Blackberry Compound).—Blackberry Root, Galls, and Cinnamon (Saigon), in equal proportions, combined	10	0.6
with smaller quantities of Cloves, Mace, and Ginger, in Blackberry Juice and Syrup.		
SODII BROMIDI.—Sodium Bromide, in Adjuvant Elixir	10	0.6
SODII HYPOPHOSPHITUM	2	0.12
SODII SALICYLATIS (to be freshly prepared when required for use)	5	0.3

Elixir—	*Active Drug in* 1 *Fluidrachm.* Grains.	4 *Cc.* Gm.
STILLINGIÆ COMPOSITUM. — Compound Fluid Extract of Stillingia, N. F.	15	1.
STRYCHNINÆ VALERIANATIS	$\frac{1}{100}$	0.0007
TURNERÆ (Damiana).—Turnera Aphrodisiaca	10	0.6
VIBURNI OPULI COMPOSITUM.—Viburnum Opulus, Aletris Farinosa, each	5	0.3
Trillium (Beth Root)	10	0.6
VIBURNI PRUNIFOLII (Black Haw)	$7\frac{1}{2}$	0.5
ZINCI VALERIANATIS.—Zinc Valerianate	1	0.06

CORDIALE RUBI FRUCTUS (Blackberry Cordial).—An aromatic Syrup of Blackberry Juice, used as a mild astringent in bowel complaints.

SUCCUS LIMONIS CUM PEPSINO (Lime Juice and Pepsin).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Pepsin.

GLYCERITA—GLYCERITES.

The Glycerites, or "Glyceroles," are solutions of substances in Glycerin.

They are made either by direct solution, by heat, or by extraction of a drug, as in Hydrastis; one is made by chemical reaction —*i. e.* Boroglycerin.

There are six official, comprising those used externally either alone or as additions to washes, gargles, injections, etc.:

Glyceritum—		*Percentage by weight.*
Acidi Carbolici	acid, carbolic	20.
Acidi Tannici	acid, tannic	20.
Boroglycerini	boroglyceride	50.
Hydrastis	representing hydrastis	100.

The following are used chiefly as pharmacal agents; the Glycerite of Starch as an excipient for Pill-masses; and the Glycerite of Egg-yolk as an emulsifying agent:

Glyceritum—		
Amyli	water 10, starch	10.
Vitelli	fresh egg-yolk	45.

The Glycerite of Starch is sometimes used externally, and is

known as Glycerin Ointment, also as "plasma." The Glycerite of Egg-yolk, also known as "glyconin," has been used as an application to sore nipples.

Unofficial Glycerites of the National Formulary.

Glyceritum—

PEPSINI (Glycerole of Pepsin).—Each 4 Cc. (fluidrachm) represents 0.3 (5 grains) of Pepsin.

PICIS LIQUIDÆ (Tar).—Containing about 0.3 (5 grains) of Tar.

TRAGACANTHÆ.—Containing about 12 per cent. of tragacanth.

MUCILAGINES—MUCILAGES.

The Mucilages are prepared by extracting a mucilaginous drug with Water or dissolving a Gum in Water.

The following four are official:

Mucilago—		*Gm. in 100 Cc., or percentage.*
Acaciæ	gum arabic	34.
Sassafras Medullæ	sassafras pith	2.
Tragacanthæ	glycerin 18; tragacanth	6.
Ulmi	slippery-elm bark	6.

The Mucilages are chiefly employed as vehicles in Mixtures to aid in suspending insoluble substances; as excipients in Pills and Troches; and as emulsifying agents. They are sometimes used for their demulcent effect.

THE LIQUID MIXTURES—INTERNAL.

MISTURÆ—MIXTURES.

THE official Mixtures are liquid preparations, for internal use, of medicinal substances dissolved or suspended in Water containing *sugar*, *gum*, or *glycerin*. They should be prepared extemporaneously. The term Mixture is also applied to any combination of substances that cannot be otherwise classified.

There are four official mixtures:

Mistura—		*Gms. in 100 Cc.*
Cretæ (Chalk Mixture)	comp. chalk powder	20.
	cinnamon water 40; water, to	100.
Ferri Comp. (Griffith's Mixt.)	myrrh, sugar, each	1.8
	potass. carb.	0.8
	triturate with gradual addition of rose water	70.
	ferrous sulphate, 0.6; spir. lavend., 6; rose water, to	100.

Mistura—		*Gms. in 100 Cc.*
Glycyrrhizæ Comp.	pure extract glycyrrhiza	3.0
(Brown Mixture)	Spirit ether nitrous	3.
	wine antimony	6.
	tinct. opium. camph.	12.
	syrup 5; mucilage acacia 10; water, to	100.
Rhei et Sodæ	sodium bicarbonate	3.5
	fl. exts. ipecac 0.3, rhubarb	1.5
	spirit peppermint 3.5; glycerin 35.; water, to	100.

Unofficial Mixtures of the National Formulary.

Mistura—

ACACIÆ—(Mistura Gummosa, Ph. Ger.).—Acacia, pulv., Sugar, in Water.

Should be freshly made when wanted for use.

ADSTRINGENS ET ESCHAROTICA (Villate's Solution).—Solution of Lead Subacet. 1½ fluidounces (45.); Sulphates of Copper, Zinc, each, 1 troy ounce (30.); Acetic Acid 13 fluidounces (360 Cc.).

AMMONII CHLORIDI (Mistura Solvens Simplex).—Ammonium Chloride, Purif. Ext. Glycyrrhiza, each 180 grains (12.), in Water 16 fluidounces (450 Cc.).

Mistura (or *Mixtura*) *Solvens Stibiata* is prepared by dissolving 0.3 Antimony and Potassium Tartrate in 1000 Cc. of Mistura Ammonii Chloridi.

CAMPHORÆ ACIDA (Mistura Antidysenterica; Hope's Mixture).—Nitric Acid 120 mins. (8 Cc.); Tinct. Opium 80 mins. (5 Cc.); in Camphor Water 16 fluidounces (450 Cc.).

CAMPHORÆ AROMATICA (Parrish's Camphor Mixture).—Tinct. Lavender Comp. 4 fluidounces (120 Cc.); Sugar 240 grains (15.); in Camphor Water 16 fluidounces (450 Cc.).

CARMINATIVA (Dalby's Carminative).—Magnes. Carb. 1 troy ounce (30.); Potass. Carb. 20 grains (1.3); Tinct. Opium 180 mins. (12 Cc.); Oils of Caraway, Fennel, Peppermint, each, 4 drops (0.1); Syrup 2½ fluidounces (75 Cc.); in 16 fluidounces (450 Cc.). Each fluidounce (30 Cc.) represents about 1 grain of Opium (0.06).

CHLORALIS ET POTASSII BROMIDI COMPOSITA (Mixture of Chloral and Bromide).—Each fluidrachm (4 Cc.) contains 15 grains (1.), each, of Chloral and Potassium Bromide,

Mistura—

and $\frac{1}{8}$ grain (0.008), each, of Exts. Indian Cannabis and Hyoscyamus.

CHLOROFORMI ET CANNABIS INDICÆ COMPOSITA (*Chloroform Anodyne*).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ minims (0.5 Cc.), each, of Chloroform and Tinct. Indian Cannabis; $3\frac{3}{4}$ minims (0.25 Cc.) Tinct. Capsicum; and about $\frac{1}{7}$ grain (0.01) of Morphine Sulph.

CONTRA DIARRHŒAM (*Cholera Mixture*).—Tinctures of Opium, Capsicum, Rhubarb, and Spirits of Camphor and Peppermint, each, equal volumes.

The above formula appears to be that in most general use, also known under the name of "Sun Mixture."

Of other similar preparations in more or less general use, the following may be mentioned here:

2. *Loomis' Diarrhea Mixture.*—Tincture Opium, $\frac{1}{2}$ fluidounce (15 Cc.); Tincture Rhubarb, $\frac{1}{2}$ fluidounce (15 Cc.); Tincture Catechu Comp., 1 fluidounce (30 Cc.); Oil of Sassafras, 20 minims (1.3 Cc.); Tincture Lavender Comp., to make 4 fluidounces (120 Cc.).

3. *Squibb's Diarrhea Mixture.*—Tincture Opium, 1 fluidounce (30 Cc.); Tincture Capsicum, 1 fluidounce (30 Cc.); Spirit of Camphor, 1 fluidounce (30 Cc.); Purif. Chloroform, 180 minims (12 Cc.); Alcohol, enough to make 5 fluidounces (150 Cc.).

4. *Thielemann's Mixture* (Mixt. Thielemanni, Ph. Suec.).—Wine Opium, 1 fluidounce (30 Cc.); Tinct. Valerian, $1\frac{1}{2}$ fluidounces (45 Cc.); Ether, $\frac{1}{2}$ fluidounce (15 Cc.); Oil Peppermint, 60 minims (4 Cc.); Fl. Ex. Ipecac, 15 minims (1 Cc.); Alcohol, to make 4 fluidounces (120 Cc.).

5. *Velpeau's Diarrhea Mixture.*—Tincture Opium, Tincture Catechu Comp., Spirit Camphor, of each, equal volumes.

COPAIBÆ COMPOSITA—

1. *Lafayette Mixture.*—Copaiba, 2 fluidounces (60 Cc.); Tinct. Lavender Comp., 2 fluidounces (60 Cc.); Solution Potassa, $\frac{1}{2}$ fluidounce (15 Cc.); Spirit Nitr. Ether, 2 fluidounces (60 Cc.); Syrup, 5 fluidounces (150 Cc.); Mucilage Dextrin, to make 16 fluidounces (450 Cc.). This mixture should be well agitated when used. Each fluidrachm contains $7\frac{1}{2}$ minims of Copaiba.

2. *Chapman's Mixture.*—Copaiba, 4 fluidounces (125 Cc.);

Mistura—

Tinct. Lav. Comp., 240 minims (15.5 Cc.); Tincture Opium, 240 minims (15.5 Cc.); Spirit Nitro. Ether, 4 fluidounces (125 Cc.); Mucilage Acacia, 1½ fluidounces (45 Cc.); Water, to make 16 fluidounces (450 Cc.).

EXPECTORANS, STOKES (Stokes' Expectorant).—Ammonium Carb., 120 grains (8.); Fl. Ext. Senega, ½ fluidounce (15 Cc.); Fl. Ext. Squill, ½ fluidounce (15 Cc.); Tinct. Opium, Camph., 2½ fluidounces (80 Cc.); Water, 1½ fluidounces (45 Cc.); Syrup Tolu, to make 16 fluidounces (450 Cc.).

GUAIACI (Guaiac Mixture, Ph. Br.).—Resin Guaiac, Sugar, each, 190 grains (12.5); Acacia Powder, 100 grains (7.); Cinnamon Water, 16 fluidounces (450 Cc.). To be well agitated when used.

MAGNESIÆ ET ASAFŒTIDÆ (U. S. P. 1880.).—Dewees' Carminative.—Magnesium Carbonate, 90 grains (6.0); Tinct. Asafœtida, 2 fluidrachms (8 Cc.); Tinct. Opium, 20 minims (1.2 Cc.); Sugar, 180 grains (12.0); Water, to make 4 fluidounces (120 Cc.).

OLEI BALSAMICA (Balsamum Vitæ Hoffmanni, Ph. Ger.).—A solution of Oils of Lavender, Thyme, Lemon, Mace, Orange-flowers, Cloves, Cinnamon, and Balsam Peru in Alcohol.

OLEI PICIS (Tar Mixture).—A mixture of Oil of Tar, ½ fluidounce (15 Cc.); Chloroform, 75 minims (5 Cc.); Oil of Peppermint, 20 minims (1.3 Cc.), in Elixir, to make 16 fluidounces (450 Cc.).

RHEI COMPOSITA (Squibb's Rhubarb Mixture).—Fl. Ext. Rhubarb, 120 minims (6. Cc.); Fl. Ext. Ipecac, 16 minims (1. Cc.); Sodium Bicarb., 330 grains (11.); Glycerin, 6 fluidounces (240.), in Peppermint Water, 16 fluidounces (450 Cc.).

SASSAFRAS ET OPII (Mist. Opii Alkalina; Godfrey's Cordial).—A mixture of Oil of Sassafras, Tincture of Opium, and Potass. Carb. in Molasses, Alcohol, and Water. Each fluidrachm (4 Cc.) contains 2 minims (0.12) Tinct. Opium, corresponding to ⅛ grain (0.01) Opium.

SODÆ ET MENTHÆ (Soda Mint).—Sodium Bicarb., 320 grains (20.); Spirit Ammonia Arom., 4 Cc. (60 minims); Spearmint Water, 16 fluidounces (450 Cc.).

SPLENETICA (Spleen Mixture; Gadberry's Mixture).—Iron Sulphate, Quinine Sulphate, Nitric Acid, each, 100 grains

Mistura—

(7.); Potassium Nitrate, 300 grains (20.), in Water, 16 fluid-ounces (450 Cc.).

SULPHURICA ACIDA (Haller's Acid Elixir, Ph. Ger.).—Sulphuric Acid, 1 part; Alcohol, to make 4 parts, by weight.

EMULSA—EMULSIONS.

Emulsions are liquid preparations consisting of *oily, fatty, resinous*, or otherwise *insoluble* substances suspended in watery liquids by the intervention of gum, mucilage, or other viscid matter.

For the internal administration of Oils it is often necessary to exhibit them in a palatable form, so that they may be borne by the stomach and their assimilation favored. This is usually effected by suspending the oil in a watery liquid or mixture by means of an *emulsifying agent*, such as acacia, etc.

Many natural substances are intimate mixtures of oils or fats with water, in the form of an emulsion. Of animal products, Milk is a most perfect emulsion; so is Egg-yolk. From the Milk-juice of some plants the water evaporates and the dried milk-juice collects in the seeds, as in almonds and other nuts, or exudes from other portions of the plant when the parts are wounded; in this way the gum-resins of asafœtida, etc. are produced. From these substances Emulsions may be obtained by restoring the water lost by evaporation—that is, by rubbing them with water in a mortar. In this way the so-called *natural* Emulsions are made.

Artificial Emulsions.

These are made by mixing the Oil with a certain proportion of the emulsifying agent, adding Water, and triturating the mixture in a mortar or agitating it in a flask.

There are various methods, but these are general rules:

The emulsification of the oil should be *complete* before the mixture is made up to the required measure.

When alcoholic liquids are to be added, they should first be *diluted* as much as possible.

Salts should be *dissolved* before being added.

No heat should be employed, as the oil *separates* when an emulsion is heated.

Emulsions should be *freshly* prepared and be preserved in a *cold* place.

The most common emulsifying agent is Powdered Gum Acacia (Acacia pulv.). The Oil is thoroughly mixed by trituration in a mortar with *one-fourth* its weight of powdered Acacia. To this *one and a half times as much* water as of gum is added *at once*, and the mixture is rapidly triturated with a rotary motion of the pestle

until it becomes stiff and assumes a milk-white color. This so-called "mother-emulsion" may now be diluted to the required measure, and other substances, flavors, etc. be added.

Powdered Tragacanth may be used in the same way or in the form of mucilage, but it does not produce so permanent emulsions as does gum acacia.

Mucilage of Acacia or of Irish Moss is not so satisfactory as powdered gum: while it produces a good emulsion, the division of the oil-globules is not so thorough as in the preceding: emulsification being incomplete, the mixture more rapidly separates into a heavier, watery liquid and a lighter, thick, gelatinous emulsion, which requires thorough mixing before use.

Extract of malt is an excellent emulsifying agent when its use is admissible. The Oil should be added to the Malt Extract contained in a capacious mortar, and incorporated in small quantities at a time. A good article will emulsify an equal volume of cod-liver oil.

Condensed Milk and Egg-yolk produce the most perfect emulsions, and also the most palatable, but they rapidly ferment and spoil.

Glycerin and sugar added to emulsions for the purpose of preservation and palatability induce separation, and their use is not advisable.

Emulsification "by intervention" is the best and only reliable method to be employed with Ethereal Oils and all substances of themselves not emulsifiable. The process is illustrated in the official Chloroform Emulsion.

Oil of Turpentine, for example, is emulsified by dissolving the Turpentine Oil in twice its volume of a bland fixed oil (Almond Oil), incorporating an equal weight of powdered Acacia, adding Water, and proceeding as with an ordinary emulsion.

Pancreatin emulsionizes fats in preparing them for digestion, but it does not produce a permanent emulsion when used artificially. While, therefore, not a reliable emulsifying agent, it aids the assimilation of oils, and its addition to emulsions is sometimes therapeutically desirable. As it is more active in alkaline media, the Emulsion should be prepared with a little Sodium Bicarbonate.

The addition of Alkalies to emulsions should be avoided. Soaps are not Emulsions, nor is the use of Soap-bark to be recommended.

Of the four official Emulsions three are natural emulsions; one is artificial:

Emulsum—	*Gm. in 100 Cc., or percentage by vol.*
Ammoniaci . . . . . ammoniac	4.
Amygdalæ . . . . . sweet almond	6.
sugar 3; acacia	1.
Asafœtidæ . . . . . asafœtida, in select tears	6.
Chloroformi . . . . tragacanth powd. 1.5; chloroform	4.
expressed oil almond 6; water, to	100.

Shake the Chloroform and Tragacanth together in a dry bottle, incorporate 25 Cc. Water, then the Almond Oil in small quantities, and finally in the same way add the remainder of the Water.

Unofficial Emulsions of the National Formulary.

Emulsions should, of all pharmaceuticals, be prepared within a reasonable period previous to the time of dispensing. A true emulsion should contain the oil simply suspended in the form of a mechanical mixture, which, from its very character, cannot withstand the effects of variation in temperature any better than a *natural* emulsion, such as milk or emulsions of almonds, gum-resins, etc., and consequently quickly degenerates or spoils.

An emulsion may be perfect—that is, the oil-globules entirely extinguished—yet a separation similar to that occurring in milk will take place, which, though in its first stage not so objectionable, will eventually impair the medicinal value of the preparation. These reasons are, it is believed, sufficient to condemn the various "ready-made" or patent emulsions, and to justify the physician in prescribing such as are kept on hand by the pharmacist, in smaller quantities, prepared according to these formulas.

A typical formula for emulsions, with Acacia, is—

℞. Olei Morrhuæ . . . . . 120 Cc., ℥iv;
Acaciæ pulv. . . . . 30 Gm., ℥j;
Aquæ. . . . . q. s. ad 240 Cc., ℥viij.

Emulsify by trituration in a mortar, and add the flavoring.

The following are flavors employed: (1) Gaultheria, (2) gaultheria and sassafras, (3) aromatic spirit, (4) gaultheria, bitter almond, and coriander, (5) gaultheria, sassafras, and bitter almond, (6) gaultheria and bitter almond, (7) oil of neroli, bitter almond, and cloves. Unless otherwise specified, that designated as No. 5 may be employed in these Emulsions.

The following formulas may be useful as indicating the form of prescription for any combination desired. Hypophosphite Salts or any medication desired may usually be dissolved in the water directed in the formula, should a preparation be indicated different from any of the following emulsions of the N. F.:

Emulsio—

Olei Morrhuæ cum Calcii et Sodii Phosphatibus.—Calcium Phosphate, Sodium Phosphate, of each, 1 grain in 1 fluidrachm (0.06 in 4 Cc.).

OLEI MORRHUÆ CUM CALCII LACTOPHOSPHATE. — Calcium Lactophosphate, 3 grains in 1 fluidrachm (0.2 in 4 Cc.).

OLEI MORRHUÆ CUM CALCII PHOSPHATE.—Calcium Phosphate, 2 grains in 1 fluidrachm (0.12 in 4 Cc.).

OLEI MORRHUÆ CUM EXTRACTO MALTI.—Contains 40 per cent. Extract of Malt.

OLEI MORRHUÆ CUM HYPOPHOSPHITE.—The Hypophosphite Salt or any combination of the following: Calcium, Potassium, Sodium, or Iron, to be directed by the prescriber, 8 grains to the fluidounce (0.5 in 30 Cc.).

OLEI MORRHUÆ CUM PRUNO VIRGINIANA.—Wild Cherry (Fluid Ext.), ½ fluidrachm to 1 fluidounce (2 Cc. in 30 Cc.).

OLEI RICINI.—1 fluidounce (30 Cc.) contains 2½ fluidrachms (10 Cc.) Castor Oil, disguised by the addition of Vanilla.

OLEI TEREBINTHINÆ.—Contains 1 fluidrachm (4 Cc.) Oil of Turpentine 1 fluidounce (in 30 Cc.), prepared according to the following formula:

℞. Olei Terebinthinæ . . . . . ʒiv, 12.5 Cc.;
Acaciæ pulv. . . . . gr. xxx, 2.0
Vitelli Ovi (Egg-yolk);
Elixir Aromatici . . . . ana ʒiv, 15 Cc.;
Aquæ Cinnamomi . . q. s. ad ʒiv, 100 Cc.

Make an emulsion by trituration in a mortar.

PHOSPHATICA (Phosphatic Emulsion).—Prepared with Glycerite of Egg-yolk, and contains in 1 fluidounce (30 Cc.) Cod Liver Oil, 2 fluidrachms (8 Cc.); Dilute Phosphoric Acid, 22½ minims (1.5 Cc.); Jamaica Rum, flavored with Bitter Almond and Orange Flower Water.

EXTRACTIVE PREPARATIONS.

THE active medicinal constituents, or principles, of crude drugs are obtained by extraction. Extraction is effected either by maceration, expression, and filtration or straining, or by maceration with heat, when it is called digestion, or by percolation. The liquid employed, termed menstruum (pl. menstrua), may be Water or Alcohol, or Alcohol and Water in various proportions, sometimes with Glycerin. A few drugs require alkaline menstrua, some acid menstrua, while the oleoresins are made with Ether.

The Infusions and Decoctions are the simplest preparations made by extraction, and represent most nearly all the soluble constituents of the drugs. But not all drugs are adapted to this method of extraction nor to this exceedingly effective, though not especially elegant, form of exhibition.

The most generally convenient and effective class of extractive preparations are the Tinctures. They are the simplest form of alcoholic preparations, and the other more concentrated preparations are usually first obtained as tinctures and then concentrated by evaporation, so as to yield the fluid extract, extract, or resin respectively.

The only accurate method for determining the doses of extractive preparations is to compare their drug-strength.

Thus, the doses of the respective preparations of Nux Vomica, based upon their relative drug-strength, would be as follows:

		Average Dose of Drug.	*Average Dose of Preparation.*
Tincture . . .	20%,	1 in 5, 3 grains (0.2)	= 15 minims (1. Cc.).
Fluid Extract	100%,	1 in 1, 3 grains (0.2)	= 3 minims (0.2 Cc.).
Extract . . .	1000%,	10 in 1, 3 grains (0.2)	= $\frac{3}{10}$ grain (0.02 Gm.).

In the same way the doses of the preparations of Opium may be presented:

		Average Dose of Drug.	*Average Dose of Preparation.*
Tincture of Opium .	10%,	1 grain (0.06)	= 10 minims (0.6 Cc.).
" " deod.	10%,	1 grain (0.06)	= 10 minims (0.6 Cc.).
Vinegar of Opium .	10%,	1 grain (0.06)	= 10 minims (0.6 Cc.).
Wine of Opium . .	10%,	1 grain (0.06)	= 10 minims (0.6 Cc.).
Extract of Opium .	150%,	1 grain (0.06)	= $\frac{2}{3}$ grain (0.04).

While the preparations of these two drugs are *standardized* according to their alkaloid percentage strength in the U. S. P., such strength is not as available for computing or estimating doses as is the drug-strength. The determination of alkaloidal percentage in preparations is a check upon their preparation, but is not of so much importance to the physician as it is that the preparations be made by a skilful and conscientious pharmacist, from the very best quality of material, in a thorough manner.

INFUSA—INFUSIONS.

Unless otherwise directed, Infusions are prepared by the general official process:

Of the Drug, coarsely comminuted	5 Gm.
Boiling Water	100 Cc.

Pour the boiling Water on the Drug in a suitable vessel, provided with a cover, and let it stand for half an hour; strain, and add enough Water through the strainer to make 100 Cc.

Caution.—The strength of Infusions of powerful drugs—*e. g.* Ipecac—should be especially prescribed. The following Infusions are official, being prepared of different strengths and by other processes than directed in the general formula:

	Gm. in 100 Cc.
Infusum Digitalis . alcohol, 10; cinnamon water, 15; digitalis	1.5
Infusum Sennæ Comp. (Black Draught) . . fennel 2; senna	6.
manna, magnesium sulph., of each	12.

Drugs whose active principles are volatile or changed by heat are prepared by percolation without heat, or cold Infusion:

	Gm. in 100 Cc.
Infusum Cinchonæ . . . . acid arom. sulph. 1; cinchona	6.
Infusum Pruni Virginianæ . . . . . wild cherry	4.

Unofficial Infusions of the National Formulary.

Infusum—

BRAYERÆ (U. S. P. 1880).—Brayera (Cusso), 6; Boiling Water, 100 Cc. To be dispensed without straining the mixture.

GENTIANÆ COMPOSITUM FORTIUS.—For preparing Infusum Gentianæ Compositum by mixing 1 volume with 3 volumes of water.

ROSÆ COMPOSITUM (Compound Infusion of Rose, Ph. Br.).—An infusion of Red Rose in diluted Sulphuric Acid, Sugar, and Water.

The Species (Teas) are mixtures of drugs contused or bruised for the preparation of Cataplasms; or Infusions and Decoctions, sometimes designated as *Haustus* (Draught). The following are in the National Formulary:

Species—

EMOLLIENTES (Emollient Cataplasm, Ph. Ger.).—A mixture of Althæa Leaves, Mallow Leaves, Melilot Tops, Matricaria, and Flaxseed, equal parts of each.

Species—

LAXANTES (St. Germain Tea, Ph. Ger.).—A mixture of Senna, Elder-flowers, Fennel, Anise, and Potassium Bitartrate.

PECTORALES (Breast Tea, Ph. Ger.).—A mixture of Althæa, Coltsfoot, Glycyrrhiza, Anise, Mullein Flowers, and Orris Root.

Infusum Pectorale (Pectoral Infusion, or Infusion of Pectoral Species) is made by infusing 1 troy ounce (30 Gm.) of the above in the usual manner, so as to obtain 10 fluid-ounces (300 Cc.) of strained product.

DECOCTA—DECOCTIONS.

Unless otherwise directed, Decoctions are prepared according to the following general process:

Of the Drug, coarsely comminuted	5 Gm.
Boiling water, to make	100 Cc.

Pour the boiling Water on the Drug, contained in a suitable vessel provided with a cover, bring it to a boil, and let it boil for fifteen minutes; let it cool to 40° C. (104° F.), express, strain, and add cold Water through the strainer to make 100 Cc.

Caution as with Infusions.

The following Decoctions are official, as being made of strengths and methods other than those directed in the general process:

	Gm. in 100 Cc.
Decoctum Cetrariæ . . . . . Iceland moss	5.
Decoctum Sarsaparillæ Comp. mezereum 1; sarsaparilla	10.
glycyrrhiza, sassafras, guaiac wood, of each	2.

DECOCTUM ALOES COMPOSITUM, N. F., is a mixture of Ext. Aloes, Myrrh, Saffron, Potass. Carb., Ext. Glycyrrh, Tinct. Cardamom Comp., and Water.—*Extempore.*

ACETA—VINEGARS.

The Vinegars are made by extraction with Dilute Acetic Acid.

By maceration:

	Gm. in 100 Cc.
Acetum Opii (Black Drop) . sugar 20; nutmeg 3; opium	10.
Scillæ . . . . . squill	10.

The Vinegars of Lobelia and Sanguinaria (U. S. P. 1880) were of the same strength.

VINA—WINES.

The Wines are made by solution, by maceration, or by maceration and percolation. The Menstruum is White Wine, to which from

10 to 15 per cent. of Alcohol is added to aid in the extraction and the preservation. There are ten Wines official.

The Natural Wines: Vinum Album and Vinum Rubrum are treated under *Alcohol.*

Vinum—		*Gm. in 100 Cc.*
Antimonii . . .	antimony, potass. tart. (sol. water)	0.4
Colchici Radicis	colchicum root	40.
Colchici Seminis	colchicum seed	15.
Ergotæ	ergot	15.
Ferri Amarum . .	soluble iron and quinine citrate	5.
(Bitter Wine of Iron)	tinct. orange peel 15; syrup	30.
Ferri Citratis	iron and ammonium citrate	4.
	syrup 10; tinct. orange peel	15.
Ipecacuanhæ	alcohol 10; fl. ext. ipecac	10.
Opii	cinnamon, cloves, each, 1; opium	10.

The *Dose* of the Vinegar and Wine of Opium is the same, 10 minims (0.6) representing 1 grain (0.06) *opii pulveris.* The dose of the Wine of Colchicum Root is 10 minims (0.6), it being nearly three times the strength of the Wine of Colchicum Seed, of which the dose is 30 minims (2 Cc.).

Unofficial Wines of the National Formulary.

The Wines, with a few exceptions, are prepared with White Wine (*Vinum album,* U. S.), usually with the addition of 10 per cent. of Alcohol, in order better to preserve the preparation.

Vinum—

ALOES (U. S. P. 1880).—Representing 6 per cent. of Aloes with Aromatics.

AURANTII.—Sherry Wine flavored with Orange.

AURANTII COMPOSITUM (Elixir Aurantiorum Compositum).—A combination of Bitter Orange Peel, Absinthium, Menyanthes, Cascarilla, Cinnamon, and Gentian, in Sherry Wine. Useful as a stomachic tonic in doses of 1 fluidrachm (4 Cc.).

CARNIS (Beef and Wine).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Extract of Beef.

The Extract of Beef in this and similar preparations is that which is prepared by Liebig's method.

CARNIS ET FERRI (Beef, Wine, and Iron).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Extract of Beef and 2 minims (0.12) Tincture of Citro-chloride ("Tasteless" Tincture) of Iron.

Vinum—

CARNIS, FERRI ET CINCHONÆ (Beef, Wine, Iron, and Cinchona).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) Extract of Beef, 2 minims (0.2) Tincture Citro-chloride of Iron, and small quantities of Cinchona alkaloids, in Angelica Wine.

COCÆ (ERYTHROXYLI).—Each fluidounce (30 Cc.) represents 30 grains (2 Gm.) of Coca in Claret Wine.

COCÆ AROMATICUM.—Each fluidounce (30 Cc.) represents 30 grains (2 Gm.) of Coca with Aromatics.

FRAXINI AMERICANÆ (White Ash).—Each fluidrachm (4 Cc.) represents 30 grains (2 Gm.) of Fraxinus (bark).

PEPSINI (Pepsin).—Each fluidrachm (4 Cc.) represents 1 grain (0.06) of Pepsin.

PICIS (Tar).—A saturated solution of Tar, in Sherry Wine.

PRUNI VIRGINIANÆ (Wild Cherry).—Each fluidrachm (4 Cc.) represents 15 grains (1 Gm.) of Wild Cherry, in Angelica Wine.

PRUNI VIRGINIANÆ FERRATUM (Wild Cherry, Ferrated).—Each fluidrachm (4 Cc.) represents 5 minims (0.3 Cc.) of Tincture of Citro-chloride of Iron and $13\frac{3}{4}$ grains (0.9 Gm.) of Wild Cherry, in Angelica Wine.

RHEI (U. S. P. 1880).—Representing 10 per cent. of Rhubarb and 1 per cent. of Calamus.

TINCTURÆ—TINCTURES.

Tinctures are liquid preparations made by the extraction of Drugs with menstrua of Alcohol and Water in various proportions. They are prepared by maceration and filtration; also by percolation:

By *maceration* and *filtration*, those containing resins and oleo-resins, Musk, and tinctures of fresh herbs; in a few instances with heat, the Tincture of Quillaja and Tincture of Strophanthus.

By *percolation*, when prepared from dried vegetable drugs—*i. e.* barks, leaves, roots, etc., usually after brief maceration.

By *solution*, mixing a solution (chloride of iron) or dissolving a solid in Alcohol (Iodine, Ext. Nux Vomica).

Assayed Tinctures.—Two of the most important Tinctures are required to be of certain specified alkaloidal strengths, and their classification according to their respective drug-strengths is therefore only approximately correct.

Tinctura Opii is made so as to represent from 1.3 to 1.5 per

cent. of crystallized morphine, the proportion obtained from 10 per cent. of Opii Pulvis, U. S.

Tinctura Nucis Vomicæ is made by solution of 2 per cent. of the official Extract, representing about ten times its weight of the drug; the Tincture therefore represents 20 per cent. of the drug, and contains 0.3 per cent. total alkaloids.

Tincturæ Herbarum Recentium.—Tinctures of Fresh Herbs, or "Green Tinctures," similar to the Homœopathic or so-called "German Tinctures," also to the specific tinctures of the Eclectics, when not otherwise directed are to be prepared by the following general formula:

Take of the fresh herb, bruised or crushed, 50 Gm.; macerate for fourteen days in Alcohol 100 Cc.; express the liquid and filter.

Tinctures of the U. S. P.

Name.	*Drug.*	*Gm. in 100 Cc.*	*Menstrua. Alcohol, per cent.*	*Average Dose.* *Drug. Grains.*	*Gm.*	*Rep. Tinct. Cc.*	*Min.*
Tinctura—							
Aconiti	Root	35	70	1	0.06	0.2	3
Aloes	Aloes	10	50	6	0.4	4.	60
	Licorice	10					
Aloes et Myrrhæ	Aloes	10	75	12	0.8	4.	60
	Myrrh	10					
	Licorice	10					
Arnicæ Florum	Flowers	20	50	3	0.2	1.	15
Arnicæ Radicis	Root	10	65	3	0.2	2.	30
Asafœtidæ	Gum resin	20	100	6	0.4	2.	30
Aurantii Amaræ	Bitter Orange peel	20	60	6	0.4	2.	30
Aurantii Dulcis	Sweet	20	100	6	0.4	2.	30
Belladonnæ Foliorum	Leaves	15	50	1½	0.1	0.6	10
Benzoini	Balsam	20	100	6	0.4	2.	30
Benzoini Composita (Turlington's Balsam)	Benzoin	12	100	8	0.5	2.	30
	Storax	8					
	Tolu	4					
	Aloes	2					
Bryoniæ	Root	10	100	3	0.2	2.	30
Calendulæ	Florets	20	100	6	0.4	2.	30
Calumbæ	Root	10	60	6	0.4	4.	60
Cannabis Indicæ	Flower tops	15	100	5	0.3	2.	30
Cantharidis	Insect	5	100	¼	0.015	0.3	5
Capsici	Fruit	5	95	1½	0.1	2.	30
Cardamomi	Fruit	10	50	6	0.4	4.	60
Cardamomi Composita	Cardamom	2	50	. .	. .	4.	60
	Cassia Cinnam.	2					
	Caraway	1					
	Cochineal	0.5					
	Glycerin	5					

Name.	Drug.	Gm. in 100 Cc.	Menstrua. Alcohol, per cent.	Average Dose. Drug. Grains.	Drug. Gm.	Rep. Cc.	Tinct. Min.
Tinctura—							
Catechu Composita	Catechu	10	50	12	0.8	4.	60
	Cinnamon	10					
Chiratæ	Herb	10	65	6	0.4	4.	60
Cimicifugæ	Rhizome	20	100	12	0.8	4.	60
Cinchonæ	Bark	20	67	12	0.8	4.	60
Cinchonæ Composita (Huxham's Tincture).	Red Cinchona	10	85	12	0.8	4.	60
	Bitter Orange peel	8					
	Serpentaria	2					
	Glycerin	7.5					
Cinnamomi	Ceylon	10	75	6	0.4	4.	60
Colchici Seminis	Seed	15	60	5	0.3	2.	30
Croci	Saffron	10	50	6	0.4	4.	60
Cubebæ	Fruit	20	100	12	0.8	4.	60
Digitalis	Leaves	15	50	2¼	0.15	1.	15
Ferri Chloridi	Solution	25 Cc.	75	4	0.25	1.	15
Gallæ	Nutgall	20	90	12	0.8	4.	60
Gelsemii	Root	15	65	2¼	0.15	1.	15
Gentianæ Composita	Gentian	10	60	12	0.8	4.	60
	Bitter Orange	4					
	Cardamom	1					
Guaiaci	Resin	20	100	12	0.8	4.	60
Guaiaci Ammoniata	Resin	20	. .	6	0.4	2.	30
Humuli	Hops	20	50	12	0.8	4.	60
Hydrastis	Rhizome	20	50	12	0.8	4.	60
Hyoscyami	Herb	15	50	5	0.3	2.	30
Iodi	Iodine	7	100	Only externally.			
Ipecacuanhæ et Opii	Ipecac	10	20	1	0.06	0.6	10
	Opium deod.	10					
Kino	Insp. juice	10	65	6	0.4	4.	60
Krameriæ	Rhatany	20	50	12	0.8	4.	60
Lactucarii	Insp. juice	50	50	For syrup.			
Lavandulæ Composita (For flavoring.)	Oil Lavender	0.8	75	. .	. .	4.	30
	Oil Rosemary	0.2					
	Cinnamon	2.					
	Cloves	0.5					
	Nutmeg	1.					
	Red Saunders	1.					
Lobeliæ	Herb	20	50	6	0.4	2.	30
Matico	Leaves	10	50	3	0.2	2.	30
Moschi	Musk	5	50	1½	0.1	2.	30
Myrrhæ	Gum resin	20	100	6	0.4	2.	30
Nucis Vomicæ	Extract	2	75	⅓	0.02	1.	15
Opii	Pulv. Opium	10	50	1	0.06	0.6	10
Opii Camphorata (Paregoric.)	Opium pulv.	0.4	50	Opium ½	0.015	4.	60
	Acid Benzoic	0.4					
	Camphor	0.4					
	Oil Anise	0.4					
	Glycerin	4.					

Name.	Drug.	Gm. in 100 Cc.	Menstrua. Alcohol, per cent.	Average Dose. Drug. Grains.	Gm.	Ref. Cc.	Tinct. Min.
Tinctura—							
Opii Deodorata	Opium	10	20	1	0.06	0.6	10
Physostigmatis	Calabar Bean	15	100	1	0.06	0.4	7
Pyrethri	Pellitory	20	100	Externally.			
Quassiæ	Wood	10	35	3	0.2	2.	30
Quillajæ	Soap Bark	20	35	6	0.4	2.	30
Rhei	Rhubarb	10	60	8	0.5	4.	60
	Cardamom	2					
Rhei Aromatica (For syrup.)	Rhubarb	20	50	15	1.	4.	60
	Cinnamon	4					
	Cloves	4					
	Nutmeg	2					
	Glycerin	10					
Rhei Dulcis (Sweet Tincture of Rhubarb.)	Rhubarb	10	50	. .	. .	8.	120
	Glycyrrhiza	4					
	Anise	4					
	Cardamom	1					
	Glycerin	10					
Sanguinariæ	Blood-root	15	60	5	0.3	2.	30
Scillæ	Squill	15	75	2½	0.15	1.	15
Serpentariæ	Rhizome	10	65	6	0.4	4.	60
Stramonii Seminis	Seed	15	50	2½	0.15	1.	15
Strophanthi	Seed	5	65	¼	0.015	0.3	5
Sumbul	Musk-root	10	65	3	0.2	2.	30
Tolutana	Tolu	10	100	3	0.2	2.	30
Valerianæ	Root	20	75	12	0.8	4.	60
Valerianæ Ammoniatæ.	Root	20	. .	6	0.4	2.	30
Vanillæ	Fruit	10	65	3	0.2	2.	30
Veratri Viridi	Rhizome	40	100	2	0.12	0.3	5
Zingiberis	Ginger	20	100	6	0.4	2.	30

Unofficial Tinctures of the National Formulary.

Tinctura—

AMARA (Bitter Tincture, Ph. Ger.).—Containing Gentian, Centaury, Bitter Orange Peel, Orange Berries, and Zedoary.

ANTACRIDA (Dysmenorrhœa Mixture; Fenner's Guaiac Mixture).—A mixture of Guaiac, Canada Turpentine, Oil of Sassafras, and ⅛ grain (0.02) Corrosive Mercuric Chloride in each fluidrachm (4 Cc.). *Dose*, from 10 to 20 minims (0.6 to 1.3 Cc.).

ANTIPERIODICA (Warburg's Tincture).—*With Aloes:* Rhubarb, Angelica Seed, of each, grains 56 (4.); Elecampane, Saffron, Fennel, of each, grains 28 (2.); Aloes (aq. ext.), Gentian, Zedoary, Cubeb, Myrrh, White Agaric, Camphor, of each, grains 14 (1.); Quinine Sulphate, grains 160 (10.); Diluted Alcohol, enough to make fluidounces 16 (473 Cc.).

Tinctura—

ANTIPERIODICA (Warburg's).—The preceding *without Aloes.* Each fluidounce (30 Cc.) of either tincture contains 10 grains (0.6) of Quinine Sulphate.

AROMATICA (Stomachic, Ph. Ger.).—A combination of Cinnamon, Ginger, Galangal, Cloves, and Cardamom.

CAPSICI ET MYRRHÆ (Hot Drops).—The preparation popularly known as "Number Six."

CINCHONÆ DETANNATÆ.—For admixture with preparations containing Iron.

CONII (U. S. P. 1880).—Representing 15 per cent. of Conium.

COTO.—This preparation contains $7\frac{1}{2}$ grains (0.5) true Bolivian Bark in each fluidrachm (4 Cc.). The Para Coto, frequently employed, differs considerably from the above.

FERRI CHLORIDI ÆTHEREA (Bestucheff's Tincture; Lamott's Drops, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $\frac{1}{2}$ grain (0.3) Metallic Iron.

FERRI CITRO-CHLORIDI (Tasteless Tincture of Iron).—Practically identical in the strength of Iron, but not in Alcohol, with the official Tincture of Chloride of Iron, containing an amount of Iron equivalent to $7\frac{1}{2}$ grains (0.5) of Dry Chloride of Iron in each fluidrachm (4 Cc.).

A convenient form of Iron for admixture with Tinctures of vegetable astringent drugs, such as Gentian and Cinchona, preparations of which it does not, unlike other iron compounds, discolor.

FERRI POMATA (Ferrated Extract of Apples; Malate of Iron, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $\frac{3}{8}$ grain (0.025) of Metallic Iron.

GUAIACI COMPOSITA (Dewees' Tincture of Guaiac).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) Guaiac.

IGNATIÆ (U. S. P. 1880).—Representing 10 per cent. of Ignatia.

IODI (Churchill's).—A solution of 10 grains (0.6) Iodine in each fluidrachm (4 Cc.), with Potassium Iodide in Alcohol.

Not to be confounded with Churchill's Iodine Caustic (Liquor Iodi Causticus).

IODI DECOLORATA (Colorless Tincture of Iodine).—Containing about 1 per cent. of Ammonium Iodide, with some other Iodine compounds, in alcoholic solution; for external use.

Tinctura—

JALAPÆ (U. S. P. 1870).—Each fluidrachm (4 Cc.) represents about 10 grains (0.6) Jalap.

JALAPÆ COMPOSITA.—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) Jalap and about 2 grains (0.12) Scammony.

KINO COMPOSITA—

Tinctures of Kino, Opium, each . .	minims	180	12. Cc.
Spirit of Camphor	"	130	8.5 "
Oil of Cloves	"	$2\frac{1}{2}$	0.15 "
Aromatic Spirit of Ammonia . .	"	15	1. "
Cochineal	grains	16	1. "
Diluted Alcohol to make fluidounces 4			120. "

Each fluidrachm (4 Cc.) represents $\frac{1}{2}$ grain (0.03), each, of Kino and Opium.

PAPAVERIS (Poppy).—Each fluidrachm (4 Cc.) represents 30 grains (2.) of Poppy (Capsule).

PECTORALIS (Bateman's Pectoral Drops).—A popular mixture of Opium, Catechu, Camphor, and Oil of Anise, containing $2\frac{1}{2}$ minims (0.15) Tincture of Opium ($\frac{1}{4}$ grain Pulv. Opium) in each fluidrachm (4 Cc.).

PERSIONIS (Cudbear).—Intended as a coloring agent when a bright-red tint or color is to be produced, particularly in acid liquids.

PERSIONIS COMPOSITA.—A mixture of Cudbear and Caramel, intended as a coloring agent when a brownish-red tint or color is to be reproduced.

PIMPINELLÆ (Pimpinella, Ph. Ger.).—Each fluidrachm (4 Cc). represents about 10 grains (0.6) Pimpinella Root.

RHEI AQUOSA (Rhubarb, Aqueous, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $5\frac{2}{3}$ grains (0.4) of Rhubarb, with alkalies, flavored with Cinnamon.

RHEI ET GENTIANÆ.—Each fluidrachm (4 Cc.) represents 5 grains (0.3) of Rhubarb and 1 grain (0.06) of Gentian.

RHEI VINOSA (Rhubarb, Vinous, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about 5 grains (0.3) Rhubarb, with Bitter Orange and Cardamom, in Sweet Sherry Wine.

SAPONIS VIRIDIS COMPOSITA.—A solution of about 15 per cent. of Green Soap and 2 per cent. of Oil of Cade.

TINCTURÆ ÆTHEREÆ (Ethereal Tinctures).—The drug, properly comminuted, troy ounces 2 (60 Gm.); Stronger Ether, 1 volume; Alcohol, 2 volumes; enough to make fluid-

Tinctura—

ounces 16 (473 Cc.). A general formula for the preparation of Ethereal Tinctures of Belladonna, Castor, Digitalis, Lobelia, Valerian, and other drugs. Official in several European pharmacopœias, and sometimes prescribed by foreign physicians.

TOLUTANA SOLUBILIS (Tolu, Soluble).—A so-called soluble essence of Tolu, for flavoring.

VANILLINI COMPOSITA.—A solution of Vanillin and Coumarin, intended for flavoring.

ZEDOARIÆ AMARA (Zedoary Comp.).—Similar to, but not identical with, the Tinctura Carminativa, Wedelii, etc., formerly official in some Continental pharmacopœias.

Each fluidrachm (4 Cc.) represents 15 grains (1 Gm.) of Zedoary, $7\frac{1}{2}$ grains (0.5) of Aloes, and $3\frac{3}{4}$ grains (0.25), each, of Rhubarb, Gentian, White Agaric, and Saffron.

EXTRACTA FLUIDA—FLUID EXTRACTS.

Fluid Extracts may be defined as a class of concentrated tinctures of such strength as to represent the drug, *volume for weight.*

The fluid extracts of the U. S. P. previous to 1880 represented 1 grain of drug in 1 minim, or 1 troy ounce in 1 fluidounce. In the U. S. P. of 1880 the standard adopted was 1 Gm. in 1 Cc., and this strength has been retained as the standard of the U. S. P. 1890.

Fluid extracts are made by *percolation, maceration,* or *digestion.* Except on a large scale or by *fractional percolation,* they cannot be prepared by simple percolation without evaporation to concentrate the percolate to the required measure.

Fractional percolation or repercolation, or simultaneous fractional percolation, by employment of which the use of heat for concentrating the percolate is avoided, may be used to advantage when the quantity operated upon is sufficiently large to warrant the greater time and attention required.

The following is the process chiefly employed:

In proceeding to percolate 100 Gm. of the drug, according to directions, the first 80 to 90 Cc. are reserved, and percolation continued until the exhaustion is completed. The weak percolate is evaporated to a soft extract (the alcohol being recovered) and dissolved in the reserved percolate. Sufficient menstruum is then added to make the product measure 100 Cc.

Official Name	*of Drug.*	*Part.*	*Average Dose.* *Cc.*	*Minims.*
Extractum Fluidum—				
Aconiti	Aconitum Napellus	Tuber	0.06	1
Apocyni	Apocynum Cannabinum	Root	1.	15
Arnicæ Radicis	Arnica montana	Root	0.5	8
Aromaticum	Pulvis Aromaticus		0.5	8
Asclepiadis	Asclepias tuberosa	Root	2.	30
Aspidospermatis	Aspidosperma Quebracho-blanco	Bark	2.	30
Aurantii Amari	Citrus vulgaris	Rind	1.	15
Belladonnæ Radicis	Atropa Belladonna	Root	0.2	3
Buchu	Barosma betulina	Leaves	2.	30
Calami	Acorus Calamus	Rhizome	2.	30
Calumbæ	Jateorrhiza palmata	Root	2.	30
Cannabis Indicæ	Cannabis sativa	Fl. Tops	0.6	10
Capsici	Capsicum fastigiatum	Fruit	0.2	3
Castaneæ	Castanea dentata	Leaves	4.	60
Chimaphilæ	Chimaphila umbellata	Leaves	2.	30
Chiratæ	Swertia Chirata	Plant	2.	30
Cimicifugæ	Cimicifuga racemosa	Rhizome	2.	30
Cinchonæ	Cinchona Calisaya	Bark	2.	30
Cocæ	Erythroxylon Coca	Leaves	2.	30
Colchici Radicis	Colchicum autumnale	Corm	0.3	5
Colchici Seminis	Colchicum autumnale	Seed	0.3	5
Conii	Conium maculatum	Fruit	0.25	4
Convallariæ	Convallaria majalis	Rhizome	0.6	10
Cubebæ	Piper Cubeba	Fruit	2.	30
Cusso	Hagenia Abyssinica	Inflor.	4.	60
Cypripedii	Cypripedium pubescens	Rhizome	1.	15
Digitalis	Digitalis purpurea	Leaves	0.12	2
Dulcamaræ	Solanum Dulcamara	Branches	2.	30
Ergotæ	Claviceps Purpurea	Sclerotium	2.	30
Eriodictyi	Eriodictyon glutinosum	Leaves	2.	30
Eucalypti	Eucalyptus globulus	Leaves	1.	15
Eupatorii	Eupatorium perfoliatum	Herb	2.	30
Frangulæ	Rhamnus Frangula	Bark	4.	60
Gelsemii	Gelsemium sempervirens	Rhizome	0.2	3
Gentianæ	Gentiana lutea	Root	1.3	20
Geranii	Geranium maculatum	Rhizome	2.	30
Glycyrrhizæ	Glycyrrhiza glabra	Root	4.	60
Gossypii Radicis	Gossypium herbaceum	Root Bark	2.	30
Grindeliæ	Grindelia robusta	Leaves	2.	30
Guaranæ	Paullinia Cupana	Seeds	4.	60
Hamamelidis	Hamamelis Virginiana	Leaves	2.	30
Hydrastis	Hydrastis Canadensis	Rhizome	2.	30
Hyoscyami	Hyoscyamus niger	Herb	0.3	5
Ipecacuanhæ	Cephaëlis Ipecacuanha	Root	0.06–2.	1–30
Iridis	Iris versicolor	Rhizome	1.	15
Krameriæ	Krameria triandra	Root	2.	30
Lappæ	Arctium Lappa	Root	2.	30
Leptandræ	Veronica Virginica	Rhizome	2.	30

Official Name	*Drug.*	*Part.*	*Average Dose* Cc.	Minims.
Extractum Fluidum—				
Lobeliæ	Lobelia inflata	Herb	0.6	10
Lupulinæ	Humulus Lupulus	Powder	0.6	10
Matico	Piper Angustifolium	Leaves	4.	60
Menispermi	Menispermum Canadense	Rhizome	2.	30
Mezerii	Daphne Mezereum	Bark	0.3	5
Nucis Vomicæ	Strychnos Nux-vomica	Seed	0.2	3
Pareiræ	Chondodendrum tomentosum	Root	2.	30
Phytolaccæ Radicis	Phytolacca decandra	Root	0.5	8
Pilocarpi	Pilocarpus Selloanus (Jaborandi)	Leaves	2.	30
Podophylli	Podophyllum peltatum	Rhizome	0.6	10
Pruni Virginianæ	Prunus serotina	Bark	2.	30
Quassiæ	Picræna excelsa	Wood	0.5	8
Rhamni Purshianæ	(Cascara sagrada)	Bark	2.	30
Rhei	Rheum officinale	Root	1.	15
Rhois Glabræ	Rhus glabra	Leaves	2.	30
Rosæ	Rosa Gallica	Petals	2.	30
Rubi	Rubus villosus	Root Bark	2.	30
Rumicis	Rumex crispus	Root	4.	60
Sabinæ	Juniperus Sabina	Tops	0.5	8
Sanguinariæ	Sanguinaria Canadensis	Rhizome	0.3	5
Sarsaparillæ	Smilax officinalis, etc.	Root	4.	60
Sarsaparillæ Compositum	Sarsaparilla, 75; Glycyrrhiza, 12; Sassafras, 10; Mezereum, 3		2.	30
Scillæ	Urginea maritima	Bulb	0.3	5
Scoparii	Cytisus Scoparius	Tops	1.	15
Scutellariæ	Scutellaria lateriflora	Herb	2.	30
Senegæ	Polygala Senega	Root	0.3	5
Sennæ	Cassia acutifolia and Angust.	Leaves	4.	60
Serpentariæ	Aristolochia Serpentaria	Rhizome	1.	15
Spigeliæ	Spigelia Marilandica	Rhizome	2.	30
Stillingiæ	Stillingia sylvatica	Root	2.	30
Stramonii Seminis	Datura Stramonium	Seed	0.2	3
Taraxaci	Taraxacum officinale	Root	4.	60
Tritici	Agropyrum repens	Rhizome	4.	60
Uvæ Ursi	Arctostaphylos Uva Ursi	Leaves	2.	30
Valerianæ	Valeriana officinalis	Rhizome	2.	30
Veratri Viridis	Veratrum viride	Rhizome	0.12	2
Viburni Opuli	(Cramp bark)	Bark	2.	30
Viburni Prunifolii	(Black haw)	Bark	2.	30
Xanthoxyli	Xanthoxylum Americanum	Bark	1.	15
Zingiberis	Zingiber officinale	Rhizome	0.6	10

Unofficial Fluid Extracts of the National Formulary.

Unless otherwise indicated, the dose of the following Fluid Extracts is from ½ to 1 fluidrachm (2 to 4 Cc.):

Extractum Fluidum—

ADONIDIS.—Root of Adonis vernalis L. (Bird's Eye).

ALETRIDIS.—Rhizome of Aletris farinosa L. (Stargrass).

ANGELICÆ RADICIS.—Root of Archangelica L. (Angelica).

APII GRAVEOLENTIS.—Seed of Apium graveolens L. (Celery).

ARALIÆ RACEMOSÆ.—Root of Aralia racemosa L. (American Spikenard).

ARNICÆ FLORUM.—Flower heads of Arnica montana L. (Arnica).

BERBERIDIS VULGARIS.—Bark of the root of Berberis vulgaris L. (Barberry).

BOLDI.—Leaves of Peumus Boldus Molina (Boldo).

BUCHU COMPOSITUM.—A combination of Buchu, 10; Cubeb, 2; Juniper, 2; Uva Ursi, 2 parts.

CALENDULÆ.—Flowering herb of Calendula officinalis L. (Marigold).

CAMELLIÆ.—Leaves of Camellia Thea Link (Tea). The best quality of commercial black tea, "Formosa Oolong," to be employed for this preparation.

CAULOPHYLLI.—Rhizome and rootlets of Caulophyllum thalictroides Mich. (Blue Cohosh).

COFFEÆ VIRIDIS.—Unroasted seeds of Coffea Arabica L.

COFFEÆ TOSTÆ.—Roasted seeds of Coffea Arabica L.

The N. F. recommends equal portions of Java and Mocha to be employed in preparing the Fluid Extracts of Coffee.

CONVALLARIÆ FLORUM.—Flowers of Convallaria majalis L. (Lily of the Valley).

COPTIS.—Rhizome of Coptis trifolia Salisb. (Goldthread).

CORNUS CIRCINATÆ.—Bark of Cornus circinata L'Hér. (Green Osier.)

CORNUS FLORIDÆ (U. S. P. 1880).—Dogwood Bark.

CORYDALIS.—Tubers of Dicentra Canadensis De C. (Turkey Corn).

COTO.—Coto bark, undetermined tree. *Dose*, from 5 to 15 minims (0.3 to 1 Cc.).

FUCI.—Thalus of Fucus vesiculosus L. (Bladder-wrack).

HELIANTHEMI.—Herb of Helianthemum Canadense Mich. (Frost-wort).

HUMULI.—Strobiles of Humulus lupulus L. (Hops).

HYDRANGEÆ.—Root of Hydrangea arborescens L. (Seven Barks).

Extractum Fluidum—

JALAPÆ.—Tuber of Exogonium purga Benth. (Jalap). *Dose*, from 15 to 20 minims (1 to 1.3 Cc.).

JUGLANDIS.—Bark of the root of Juglans cinerea L. (Butternut).

JUNIPERI.—Fruit of Juniperus communis L.

KAVA.—Root of Piper methysticum Forster (Kava; Kava-Kava).

LACTUCARII (U. S. P. 1880).—Insp. juice of Lactuca virosa L.

MALTI.—(Fluid Extract of Malt).

MENYANTHIS.—Leaves of Menyanthes trifoliata L. (Buckbean; Trifolium fibrinum, Ph. G.).

MEZEREI (U. S. P. 1880).—Bark of Daphne mezereum L. *Dose*, from 5 to 10 minims (0.3–0.6 Cc.).

PETROSELINI RADICIS.—Root of Petroselinum sativum Hoffman (Parsley).

QUILLAJÆ.—Bark of Quillaja Saponaria Molina (Soap Bark).

RHAMNI PURSHIANÆ AROMATICUM.—Cascara Sagrada deprived of its bitter taste.

RHEI AROMATICUM.—A combination of Rhubarb, Cinnamon, Cloves, and Nutmeg.

SENNÆ DEODORATUM (Aqueous Fluid Extract of Senna).—This preparation is free from the objectionable "griping" qualities of the ordinary fluid extract.

STERCULIÆ.—Seeds of Sterculia acuminata R. Brown (Cola or Kola).

STILLLINGIÆ COMPOSITUM (Stillingia Comp.).—Stillingia, Corydalis, each, 4 parts; Iris, Sambucus, Chimaphila, each, 2 parts; Coriander, Xanthoxylum Berries, each, 1 part.

TRILLII.—Rhizome of Trillium erectum L. (Bethroot).

TURNERÆ.—Leaves of Turnera microphylla De C. (Damiana).

URTICÆ.—Root of Urtica dioica L. (Nettle).

VERBASCI.—Leaves (and flowers) of Verbascum Thapsus L.

VERBENÆ.—Root of Verbena hastata L. (Vervain).

ZEÆ.—Stigmatum Maydis; Corn Silk; Stigmata of Zea Mays L. (Indian Corn).

As a rule, a Fluid Extract is made of every vegetable drug which is a part of a plant. There are altogether about 500 Fluid Extracts. Relatively, the Fluid Extracts are not as strong as the Tinctures, but they have the great advantage over the latter in that they are more concentrated and of uniform drug-strength—the strength of the drug.

EXTRACTA—EXTRACTS.

Extracts—or "solid" extracts as they are termed, to distinguish them from fluid extracts—are the soluble active principles of vegetable drugs, concentrated by evaporation to a soft solid or a plastic mass of pilular consistence.

The *strength* of an extract depends upon the amount of the crude drug it represents. Hence, the *smaller* the percentage of extract obtained from a drug, the *greater* the relative strength of the extract, provided that the drug be exhausted with menstrua adapted to secure all the active principles in this form.

The yield of extract is influenced by the character of the menstruum employed: with a few drugs like Rhubarb the quality of the drug sometimes governs the yield, the least percentage being obtained from the poorest quality.

As a general rule, the more *aqueous* the menstrua, the *greater* the yield of extract; conversely, the more *alcoholic* the menstrua, the *smaller* the yield of extract. To obtain the extracts, therefore, of official *strength* it is necessary to use official *menstrua* in the extraction.

Thus the extracts of different drugs are as many times stronger than the drug as the quotient obtained by dividing the drug at 100 by the percentage yield. For example: Podophyllum yields 10 per cent. of extract; then $100 \div 10 = 10$; that is, the extract is ten times as strong as the drug and the fluid extract, or 0.1 of the extract represents 1 Gm. of the drug or 1 Cc. of the fluid extract. The drug-strengths of the official Extracts, calculated by this method, as well as their relative doses based upon the amounts of drug they represent, are exhibited in the table given on page 96.

The 33 official Extracts are made by extraction with alcoholic menstrua or with water, sometimes by the addition of *acid* or *alkali*.

There are four extracts made by the addition of powders to the extracts, including the Extract of Colocynth, the Compound Extract of Colocynth, and the assayed extracts, made by the addition of Sugar of Milk to represent a certain alkaloidal strength in the powdered extract.

Extractum Nucis Vomicæ contains 15 per cent. of total alkaloids; 1 Gm. represents about 10 Gm. of drug.

Extractum Opii contains 18 per cent. of crystallized morphine; 1 Gm. represents 2 Gm. of normal moist opium, about 1.4 *Opii pulvis* (14 per cent. morphine).

Table showing the Drug-strength and the Average Doses of the Official Extracts.

Extractum.	Part.	Parts of Drug in 1 part of Extract.	Dose of Drug.		Dose of Extract.	
			Grains.	Gm.	Grains.	Gm.
Aconiti	Root	5	1	.06	½	.012
Aloes (aqueous)		2	10	.65	5	.32
Arnicæ	Root	5	10	.65	2	.12
Belladonnæ Fol. Alcoholic.	Leaves	5	3	.2	½	.03
Cannabis Indicæ	Herb	10	10	.65	1	.06
Cimicifugæ	Rhizome	10	10	.65	1	.06
Cinchonæ (Calisaya)	Bark	6	30	2.	5	.3
Colchici (acetic)	Corm	3	5	.3	2	.12
Colocynthidis (powder)	Fruit	6	3	.2	½	.03
Colocynthidis Compositum (powder)	Ext. Colocynth, 16; Cardamom, 6; Aloes, 50; Soap, Scammony, each, 14.	..	..	..	5	.3
Conii (acetic)	Fruit	4	4	.25	1	.06
Digitalis	Leaves	4	2	.12	¼	.03
Ergotæ	Sclerot.	5	30	2.	6	.4
Euonymi	Bark	5	30	2.	6	.4
Gentianæ (aqueous)	Root	4	20	1.3	5	.3
Glycyrrhizæ (stick)	Root	3	30	2.	10	.65
Glycyrrhizæ Purum (ammon.)	Root	3	60	4.	20	1.3
Hæmatoxyli (aqueous)	Logwood	4	10	.65	2½	.15
Hyoscyami	Herb	6	6	.4	1	.06
Iridis	Rhizome	7	7	.5	1	.06
Jalapæ	Tuber	6	15	1.	3	.2
Juglandis	Bark	6	15	1.	3	.2
Krameriæ (aqueous)	Root	5	15	1.	3	.2
Leptandræ	Root	5½	15	1.	3	.2
Nucis Vomicæ (powder)	Seed	10	3	.2	½	.02
Opii (powder)		1⅓	1	.06	¾	.04
Physostigmatis	Calabar bean	20	1	.06	½	.01
Podophylli	Rhizome	10	10	.65	1	.06
Quassiæ (aqueous)	Wood	25	5	.3	1	.06
Rhei	Root	3	30	2.	10	.65
Stramonii	Seed	10	3	.2	¼	.15
Taraxaci (aqueous)	Root	3	30	2.	10	.65
Uvæ Ursi	Leaves	3	30	2.	10	.65

ABSTRACTA—ABSTRACTS.

A class of *powdered* extracts, prepared from the extracts by the addition of sufficient Milk Sugar to make the product represent one-half its *weight* of the crude drug, was official in the U. S. P. VI. (1880) under the title of Abstracts.

The Abstracts have a uniform relation to the drug—viz. *1 grain represents 2 grains of the drug*, just as the fluid extracts have the uniform relation of representing the drug *measure* for *weight*.

In preparing an abstract the drug is exhausted, the extract obtained incorporated with its weight of Milk Sugar, the mixture

powdered, and enough Milk Sugar added to bring the product to one-half the weight of the drug employed. Abstracts must be preserved in small, perfectly dry, and well-corked vials in a dry and cool place.

Their uniformity alone should have favored the employment of Abstracts in preference to the Extracts, since they do not share the variability in strength of the extracts, the *dose* of the Abstract being exactly one-half that of the crude drug or Fluid Extract. This advantage was offset by the disadvantage that Abstracts are more bulky, and caused their deletion in the U. S. P. 1890. The Abstracts are therefore unofficial.

The official Extracts of Jalap and of Nux Vomica have superceded the abstracts of these respective drugs in a more concentrated and equally convenient form. Of the remaining nine Abstracts formerly official, Aconite, Belladonna, Conium, Digitalis, Hyoscyamus (Ignatia, superceded by Nux Vomica), Podophyllum, Senega, and Valerian, the five first mentioned, commonly but erroneously called the "narcotic extracts," may be prepared, in the powdered form, of such strength as to represent the same drug-strength as their respective official "solid extracts."

EXTRACTUM FERRI POMATUM, N. F.—Ferri Malas Crudus (Ferrated Extract of Apples, Ph. Ger.).

EXTRACTUM GLYCYRRHIZÆ DEPURATUM, N. F.—Succus Liquiritiæ, Ph. Ger. (Purified Extract of Liquorice).

OLEORESINÆ—OLEORESINS.

To natural Oleoresins, derived as plant-exudations, belong the Turpentines and the Pitches. From similar exudations are obtained the Gum Resins, mixtures of Gum and Resins and sometimes Volatile Oils; also the Balsams, which are Resins or Oleoresins associated with Benzoic or Cinnamic Acid. These are treated under their respective Drugs.

The *pharmaceutical* Oleoresins are semi-liquid extracts, obtained by exhausting oleoresinous drugs with Ether.

Ether extracts *fixed* and *volatile oils* from drugs, as well as *resin;* these principles constitute therefore the oleoresins, which sometimes also contain other active matter in solution or suspension.

The menstruum (Ether), being easily volatilized, is recovered by distillation; it is sometimes superseded by Alcohol, which yields an extract very similar to that obtained with ether.

The six following are official:

Oleoresina—	*Dose.*	
Aspidii; separates in two layers, to be mixed when used . . .	1–2 drachms.	4.–8.
Capsici; separates fat, used only as corrective	$\frac{1}{12}$–$\frac{1}{6}$ grain.	0.01–0.005
Cubebæ; separates wax	1–2 grains.	0.06–0.1
Lupulinæ	2–3 grains.	0.1–0.2
Piperis; separates piperine, to be rejected	1–2 grains.	0.08–0.1
Zingiberis	$\frac{1}{6}$–$\frac{1}{3}$ grain.	0.02–0.01

RESINÆ—RESINS.

The official Resins may be divided into the (1) Natural Resins, (2) Resins obtained from Oleoresins by separating the Volatile Oil by distillation, and (3) the Pharmaceutical Resins, prepared by *precipitation.*

When a concentrated tincture of a resinous drug is poured into a large quantity of cold water, the resinous matter becomes insoluble and is precipitated; this, after being washed, dried, and sometimes powdered, is termed a *resin.*

Resins are usually *soluble* in alkalies and *insoluble* in acids (dilute); for this reason the water used for precipitation is sometimes rendered slightly acid to favor the separation.

The three following are official:

Resina—	*Per cent. yield from Drug.*	*Dose.*		*Rep. Drug.*	
Jalapæ	15	3 grains	0.2	20 grains	1.3.
Podophylli	5	½ grain	0.03	10 grains	0.6.
Scammonii	65	3 grains	0.2	5 grains	0.3.

Resina and Resina Copaibæ are obtained as residue in the distillation of the respective Oleoresins, Turpentine and Copaiba. The natural Resins are obtained as exudates—*e. g.* R. Guaiaci.

The terms *resin*, *resinoid*, and *concentration* are also applied to a class of preparations used by eclectic physicians, prepared by this general process with some modifications. (See U. S. and Am. Disp.)

They are named after their respective Drugs with the ending *in*, as in Glucosides, and must not be confused with the latter. While the Glucosides are usually the active medicinal constituents representing the drug, the resinoids, with the exception of those made

from drugs whose active principles are resins, such as Cimicifuga and Podophyllum, are more or less inert, unreliable mixtures, too indefinite in their composition and strength for medicinal use.

SOLID MIXTURES FOR INTERNAL USE.

MIXTURES of Solids for internal use embrace the following classes of preparations: Powders, Effervescent Salts, Confections, Troches, Masses, and Pills.

Powders are substances reduced to a fine pulverulent condition to favor their administration and solution or absorption. A powder may be *simple*, such as a powdered drug, *Pulvis opii*, or a powdered salt—*i. e. Quininæ sulphas;* or it may be *compound*, a mixture of several substances.

Sparingly soluble substances, when finely powdered (impalpable) and thoroughly mixed by trituration in a mortar with some inert powder (diluent) such as Milk Sugar, are rendered more soluble, since a greater surface is exposed to the solvent action of the liquids of the body, and prompter and fuller effects are obtained. The potency of calomel, of the resins, and of alkaloids is in this way considerably increased within certain limits, but not to the unreasonable extent advocated by Homœopathic pharmacy, in which this process is carried to a *reductio ad absurdum*. It is an excellent and convenient method for dispensing and administering the more potent agents, such as arsenous acid, mercury compounds, and the alkaloids. Substances triturated in this way have been called *Triturations*, for whose preparation the U. S. P. gives a general formula:

Take of the substance, for example, Elaterin . . . 1 Gm.
Milk Sugar, in fine powder . . . . . 9 Gm.

First thoroughly triturate the medicinal substance (Elaterin) with an equal weight of Milk Sugar, then add the remainder of the Milk Sugar, and mix thoroughly by trituration (for about ten minutes).

Unless otherwise specified, triturations should be of the official strength—*i. e.* 10 per cent. of the drug.

By the addition of about an equal weight of Alcohol to the triturate it becomes a soft mass, which, after being moulded into

disks of about 1 grain (0.06) each, after the evaporation of the Alcohol, furnishes the so-called *Tablet Triturates.* These afford a convenient method of medication for such substances as are adapted to trituration, which is, however, confined, as indicated, to a comparatively limited number of agents. To represent in the form of these tablets every kind of medicinal agent of volatile character, or drugs otherwise susceptible to change through the inevitable exposure to the atmosphere to which every such mixture is liable, is simply to invite error in practice. These tablets, moreover, with certain chemical substances, undergo chemical changes which render them entirely insoluble, and thus practically inert. In order to be effective and otherwise reliable, they should be prepared extemporaneously by the pharmacist, in order to ensure their solubility.

They should always be dissolved in a little water before they are administered.

When it is desired to obtain a mild and prolonged local effect of a medicinal agent in the mouth or throat, the substance is made into a soft mass (*confection*) with a diluent and excipient, Sugar and Mucilage, and flavor, and formed into round or oval-shaped disks, weighing from 8 to 30 grains (½ to 2 Gm.), called variously Lozenges, Troches, Tablets, and Pastils.

Troches.—When these are allowed to dissolve slowly in the mouth the diluent serves as a vehicle for the medicinal agent, and a gradual prolonged effect is obtained upon the mucous surfaces. This form of medication is adapted only to astringents, antacids, expectorants, and stomachics consisting of substances not especially disagreeable to the palate.

Tablets, or *Lozenges*, are not intended to be swallowed, nor adapted to exceedingly volatile, caustic, irritant, or otherwise unpalatable substances. For ingestion, medicinal agents should be made into a Mass (*massa*) with an excipient, and formed into small spheres, or balls, as a rule not over 5 grains (0.3) in weight, to be swallowed and slowly dissolved in the stomach or intestines. Such preparations are the so-called *Pills* (*Pilulæ*, from *pila*, ball).

PULVERES—POWDERS.

The nine official Powders are impalpable mixtures of one or more active drugs, usually with some nearly inert substance, such as Sugar, as a *diluent*, and Aromatics.

They are made by trituration.

Pulvis— *Gm. in 100.*

Antimonialis (James')	calc. phos. 67; antimon. oxide	33.
Aromaticus	cinnamon (Ceylon), ginger, each	35.
	cardamom (seed), nutmeg, each	15.
Cretæ Compositus	acacia p. 20; sugar 50; prep. chalk	30.
Glycyrrhizæ Compositus	senna 18; glycyrrhiza	24.
	fennel oil 0.4; sulphur, washed, 8; sugar	50.
Ipecacuanhæ et Opii	ipecac, opium pulv., each	10.
(Dover's Powder)	sugar of milk	80.
Jalapæ Compositus	potass. bitartrate 65; jalap	35.
Rhei Compositus	magnesia 65; ginger 10; rhubarb	25.

In 60 grains.

Pulv. Morphinæ Compositus	camphor 10; morphine	
(Tulley's Powder)	sulph.	1.
	calcium carb., precip.; glycyrrhiza p., each	20.

For 12 pow.; in each, grains.

Effervescens Compositus	(Seidlitz Powder)	
	potassium and sodium tartrate 93 Gm.	120
	sodium bicarbonate 31 Gm.	40
	acid tartaric. 27 Gm.	35

Many methods are in use for the purpose of disguising the taste of disagreeable remedies in the powder form. Of these the most elegant and effective method is that of enclosing the powder in a *cachet* or wafer. Originally wafers were made of starch-paste in thin sheets; a piece about 0.5 dcm. (2 inches) square, immersed in water for a minute, being placed in a spoon, the powder poured into it, and then enwrapped by folding up the edges and swallowed with a little water. The cachets or "konseals" are wafer-disks consisting of two concentric halves, one of which is filled with the powder, and the other half attached by moistening the edge and pressing the edges together by means of various devices. These cachets are of three sizes, the largest holding 5 grains (0.3) Quinine Sulphate. After one minute's immersion in water they can be swallowed without any effort.

Unofficial Powders of the N. F.

Pulvis—

ACACIÆ COMPOSITUS (Pulvis Gummosus, Ph. Ger.).

ACETANILIDI COMPOSITUS.—Containing 50 per cent. Acetan-

Pulvis—

ilid, 2 per cent. Caffeine, with Tartaric Acid and Sodium Bicarbonate.

ALOES ET CANELLÆ (Hiera Picra).

AMYGDALÆ COMPOSITUS (Almonds Comp.)—A mixture of Sweet Almond, Sugar, and Acacia, in fine powder; 180 grains (10 Gm.), triturated with Water, yield about 4 fluid-ounces (119 Cc.) of Emulsum Amygdalæ.

ANTICATARRHALIS (Catarrh Snuff.)—Hydrochlorate of Morphine, 1 part; Acacia, 60 parts; Subnitrate of Bismuth, 180 parts, in fine powder.

CATECHU COMPOSITUS (Compound Powder of Catechu, Ph. Br.).—Catechu, 4 parts; Kino, 2 parts; Krameria, 2 parts; Cinnamon, 1 part; Nutmeg, 1 part.

CRETÆ AROMATICUS.—A mixture of Cinnamon, Saffron, Nutmeg, Cloves, Cardamon, prepared Chalk, and Sugar.

CRETÆ AROMATICUS CUM OPIO.—Aromatic Powder of Chalk, with 1 grain (0.06) of powdered Opium, in 40 grains (1.5) of the mixture. Official in the Ph. Br.

HYDRARGYRI CHLORIDI MITIS ET JALAPÆ (Calomel and Jalap).—A mixture of Mild Chloride of Mercury, 10 grains (0.6), and Jalap, 20 grains (1.3).

When "Calomel and Jalap" is prescribed for an adult, without any specification of quantities, the N. F. recommends that the above mixture be dispensed as one dose.

IODOFORMI COMPOSITUS (Iodoform and Naphthalin).—A mixture of Iodoform, 2 parts; Boric Acid, 3 parts; Naphthalin, 5 parts; with Oil of Bergamot, in fine powder.

This powder is used in many cases where a diluted preparation of Iodoform, for external purposes, is desired. The odor is masked both by the Oil of Bergamot and by the Naphthalin.

KINO COMPOSITUS.—A mixture of Kino and Cinnamon, with 1 grain (0.06) of Powdered Opium in each 20 grains (1.3).

MYRICÆ COMPOSITUS (Composition Powder).—A mixture of Bayberry, Ginger, Capsicum, and Cloves.

PANCREATICUS COMPOSITUS (Peptonizing Powder).—A mixture of 20 parts Pancreatin and 80 parts Sodium Bicarbonate; 25 grains will peptonize 1 pint of milk.

PEPSINI COMPOSITUS (Pulvis Digestivus).—A mixture of Pepsin, Pancreatin, Diastase, Lactic and Hydrochloric Acids, with Milk Sugar to represent the gastric juice.

Pulvis—

RHEI ET MAGNESIÆ ANISATUS (Compound Anise Powder.)—A mixture of Rhubarb, Heavy Magnesia, and Oil of Anise.

TALCI SALICYLICUS (Salicylated Powder of Talcum).—A mixture of Talcum with 3 per cent. Salicylic Acid and 10 per cent. Boric Acid, in fine powder.

Powders are usually directed to be divided into papers (*chartulæ*); thus, for example, a formula for a prescription would be—

℞. Hydrargyri Chloridi Mitis . . 1.
Sacchari Lactis . . . . . 9.
Misce cum triturationе et in chartulis No. x. divide.

Encapsuling powders by filling them in gelatin capsules is a very convenient and elegant form of administration. No mixture which is desired to be given in the form of *powder*, however, should be made into a mass for facilitating the encapsuling process—a custom too frequently adopted. Many substances, especially Bismuth Subnitrate and Calomel, become exceedingly hard and quite insoluble when made into a mass. No dispenser should assume the prerogative of changing the form of medication prescribed.

SALES EFFERVESCENTES—EFFERVESCENT SALTS.

These are granulated mixtures of Salts with Sugar and Sodium Bicarbonate and Tartaric Acid, which decompose when the Salt is dissolved in Water and furnish agreeable aërated draughts.

The following are official, the strength indicated being that contained in 90 grains (6 Gm.), a heaped teaspoonful being the ordinary dose, dissolved in about 6 fluidounces (180 Cc.) of water:

Caffeina Citrata Effervescens	caffeine	0.06
Lithii Citras Effervescens	lithium citrate	0.06
Magnesii Citras Effervescens .	magnesium citrate	1.0
Potassii Citras Effervescens . . .	potassium citrate	3.0

Effervescent Salts (Granular), N. F.

The strength given for these is the quantity contained in 90 grains (6 Gm.), which represents about the quantity of these Salts contained in a heaped teaspoonful of ordinary size, the average dose.

FERRI ET QUININÆ CITRAS EFFERVESCENS, 1 grain (0.06) Citrate of Iron and Quinine.

FERRI PHOSPHAS EFFERVESCENS, 2 grains (0.12) Phosphate of Iron.

POTASSII BROMIDUM EFFERVESCENS, 20 grains (1.3) Potassium Bromide.

POTASSII BROMIDUM CUM CAFFEINA, 10 grains (0.6) Potassium Bromide and 1 grain (0.06) Caffeine.

SAL CAROLINUS FACTITIUS EFFERVESCENS (Effervescent Carlsbad Salt, artificial).—A solution of about 87 grains (5.5) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Carlsbad Water (Sprudel).

SAL KISSINGENSIS FACTITIUS EFFERVESCENS (Effervescent Kissingen Salt, artificial).—A solution of about 80 grains (5 Gm.) in 6 fluidounces (178 Cc.) represents an equal volume of Kissingen Water (Rakoczy).

SAL VICHYANUS FACTITIUS EFFERVESCENS (Effervescent Vichy Salt, artificial).—A solution of about 57 grains (4 Gm.) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Vichy Water (Grand Grille).

Salts (Non-effervescent).

SAL CAROLINUS FACTITIUS.—In two forms, Dry (Ph. Ger.) and Crystalline. A solution of about 16 grains (1 Gm.) of the Dry (27 grains (1.8) of the Crystalline) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Carlsbad Water (Sprudel).

SAL KISSINGENSIS FACTITIUS.—A solution of about 24 grains (1.5) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Kissingen Water (Rakoczy).

SAL VICHYANUS FACTITIUS.—A solution of about 14 grains (1 Gm.) in 7 fluidounces (207 Cc.) of Water represents an equal volume of Vichy Water (Grand Grille).

CONFECTIONES—CONFECTIONS.

Confections may be defined as flavored masses wherein the adhesive substance is Sugar in large proportions, serving as a *vehicle* for masking the taste of the drug.

Confections, when made by beating a fresh drug, first reduced to pulp with sugar until of the proper consistence, are termed *conserves*. When made from powders or extracts they are called *electuaries*.

Only one representative of each class is official:

		Gm. in 100 Cc.
Confectio Rosæ	rose water 16, red rose	8.
(Conserve of Rose)	sugar 64, honey	12.
Confectio Sennæ . (*Electuar. Sennæ*)	oil coriander 0.5, senna	10.
	cassia fistula 16, fig 12, tamarind	10.
	prune 7, sugar 55, water to	100.

The Confection of Senna is a very agreeable laxative, especially adapted for constipation in women and children. It is exceedingly agreeable to the taste.

TROCHISCI—TROCHES.

Troches, or *lozenges*, are confections made into various forms and then dried.

The vehicle or excipient consists of Powdered Gum Tragacanth or Sugar with flavoring—in some cases orange flower water, in others tolu, nutmeg, vanilla, etc.

The active ingredients are mixed with the diluent or vehicle and made into a plastic mass with the particular excipient, Water or Syrup. The mass is rolled out to the requisite thickness, and the disks formed by cutting through it with a *punch* or troche-cutter. The troches are then dried by exposure.

The size and weight of the troche are regulated by the thickness of the mass and the diameter of the cutter.

The 15 official Troches vary in weight from Gm. 0.5 to 1.5.

	Active Drug.			
Trochisci—	*Gm. in 100 Troches.*	*Gm. in each Troche.*	*Grains in each Troche.*	
Acidi Tannici	6.	0.06	1	Orange flor.
Ammonii Chloridi	10.	0.1	1½	Tolu.
extract glycyrrhiza	25.	0.25	4	
Catechu	6.	0.06	1	Orange flor.
Cretæ	25.	0.25	4	Nutmeg.
Cubebæ . . . . oleoresin	4.	0.04	⅔	
extract glycyrrhiza	25.	0.25	4	
sassafras oil	1.	0.01	⅙	
Ferri . . . ferric hydrate	30.	0.3	5	Vanilla.
Glycyrrhizæ et Opii				
ext. glycyrrhiza	15.	0.15	2½	Anise.
powd. opium	0.5	mg.5.	1/12	

	Active Drug.			
Trochisci—	*Gm. in 100 Troches.*	*Gm. in each Troche.*	*Grains in each Troche.*	
Ipecacuanhæ	2.	0.02	$\frac{1}{3}$	Orange.
Krameriæ . . . . extract	6.	0.06	1	" flor.
Menthæ Piperitæ . . . oil	1.	0.01	$\frac{1}{6}$	Peppermint.
Morphinæ . morphine sulph.	0.16	mg. 16	$\frac{1}{60}$	Gaultheria.
et Ipecac. powd. ipecac	0.50	" 5.	$\frac{1}{12}$	
Potassii Chloratis	30.	0.3	5	Lemon.
Santonini	3.	0.3	$\frac{1}{2}$	Orange flor.
Sodii Bicarbonatis	20.	0.2	$\frac{1}{3}$	Nutmeg.
Zingiberis . . tinct. ginger	20.	0.2	$\frac{1}{3}$	Ginger.

Lozenges of Peppermint, Lemon, Musk, Vanilla, and Gaultheria may readily be prepared by saturating sugar lozenges with the respective essences or tinctures and permitting the alcohol to volatilize.

MASSÆ—MASSES.

Masses are plastic mixtures of *pilular* consistence. They are made by incorporating the drug with adhesive substances, by chemical reaction, and sometimes by both processes.

The Masses are intended to be formed into pills whenever they are to be dispensed. They are therefore often called Pil., *Pilulæ*, instead of Massa. There are only three official:

Massa Copaibæ . . . . water 1, magnesia 6, copaiba 94.

The Copaivic Acid combines with the magnesia, forming magnesium copaivate of pilular consistence. This is also known as "solidified copaiba."

Massa Ferri Carbonatis (Vallet's Mass) { sodium carb., ferrous sulph., each 100., honey 38, sugar 25, syrup to 100.

By double decomposition between the Ferrous Sulphate and Sodium Carbonate *ferrous carbonate* is formed, which is incorporated with Honey and Sugar to prevent oxidation and to render the mixture a plastic mass. The Pill of Ferrous Carbonate (Pil Blaudii) is preferable to this mass, as in the pill the ferrous carbonate is better protected against oxidation.

Massa Hydrargyri (Blue Mass) . glycyrrhiza 5, althæa 25, mercury 33, glycerin 3, honey of rose 34.

The mercury is extinguished by trituration with the rose honey and glycerin and the powdered glycyrrhiza; the other ingredients are then incorporated. The usual dose is from 5 to 10 grains (0.3–0.6).

PILULÆ—PILLS.

Pills are spherical, more or less soluble masses of medicinal substances rendered *cohesive*, *plastic*, and *firm* in consistence by the addition of some substance (usually inert) termed an *excipient*.

The *kind* of excipient employed varies with the nature of the medicinal substance. As a general rule, such substances are chosen as give to the mass, with the smallest proportion, the greatest plasticity, and also best preserve the spherical shape of the pills. The excipient must also, unless the contrary be directed for especial purposes, be indifferent in character, to avoid change in the medicinal agents.

Soluble substances are rendered adhesive by the action of solvents, and require, according to their solubilities, the addition of some liquid such as Water, Alcohol, Glycerin, etc. Others require the addition of adhesive substances, such as Syrup, Mucilage, Glucose, Glycerite of Starch or Tragacanth, etc.

Drugs adapted for dispensing in the form of pills may be divided as follows:

(1) The official Masses, Extracts, and Scaled Salts.

Masses and extracts, being of pilular consistence, require no addition except when hard or dry; Water should then be incorporated to restore them to their original form. Abstracts and powdered extracts are best made into a mass with Water.

(2) Vegetable Powders in which the dose does not exceed five grains.

With these *adhesive* excipients are indicated, such as Syrup, Mucilage, Glycerite of Tragacanth, and Glucose. The last mentioned answers the requirements better than most other substances. Confection of Rose and Extracts of Gentian, Glycyrrhiza, and Taraxacum are also used when their color is not objectionable.

(3) Salts not too deliquescent, and Alkaloids.

Excipients for these must combine *adhesive* and *absorbent* qualities. They are first triturated with a dry powder—*e. g.* Althæa, Glycyrrhiza, or Milk Sugar—and then mixed with the adhesive substance—viz. Glucose or Glycerite of Starch or Tragacanth.

No excipient must be used that will give to the mass a color different from that of the medicinal ingredients (the base).

(4) Volatile Oils and Oleoresins.

The quantity of these when dispensed in pills being comparatively large, it is necessary to add some light *absorbent* substance, such as Magnesia or Starch, to which is added the adhesive material. The practice of adding wax or resin to oils is not to be recommended except as a last resort, since they tend to render the pill insoluble.

(5) Resins and Gum Resins.

These form an adhesive mass by the addition of a little Alcohol, with which more bulky excipients, such as Soap, may be incorporated to preserve the shape of the pill.

(6) Salts of the Cinchona Alkaloids, Quinine and Cinchonidine Sulphates, etc.

These are often prescribed in pill form in large doses, and it is therefore desirable to reduce their bulk. For this purpose dilute Sulphuric Acid or Tartaric Acid is added in small quantity, which acts as a solvent upon the salt, thereby converting it into a mass. This mass is incorporated with a little Glycerite of Starch, otherwise it soon loses its plasticity; it must therefore be rolled into pills as soon as formed.

(7) Substances easily decomposed by organic matter.

Potassium Permanganate and Silver Nitrate are quickly "reduced" when incorporated with the excipients usually employed. These should be mixed with an inorganic diluent not affected by them, such as Kaolin, Pipe Clay, or Fullers' Earth, and made into a mass with Water, Petrolatum, Resin Cerate, etc.

In order to disguise the bitter or otherwise disagreeable taste of pills, they are usually coated with sugar or gelatin. These coated pills are often objectionable on account of the coating, or the pill itself, becoming quite insoluble. When a coated pill is desired, it should be freshly made and enclosed in a gelatin capsule of the smallest size. Pills may also be coated extemporaneously by rolling them on a piece of filter-paper saturated with Mucilage of Acacia, and then in powdered Milk Sugar.

Keratin-coated pills are designed for solution in the duodenum, the pills being dipped in a solution of Keratin prepared from horn shavings treated with pepsin and hydrochloric acid.

Concentric pills are made up of concentric layers of different ingredients, intended to dissolve and become active at various stages in their passage through the intestinal tract.

The following 15 Pills are official:

Pilulæ.	Gm. for 100.	In each. cg.	In each. grains.	Excipient.
Aloes . . . . . aloes purif., soap, each	13	13	2	Glyc. water.
Aloes et Asafœtidæ . aloes, asafœtida, soap, each	9	9	1½	"
Aloes et Ferri . . aloes, iron sulph., arom. powder	7	7	1	Conf. rose.
Aloes et Mastiches (Dinner Pill) . . . . aloes	13	13	2	
mastic	4	4	¾	
red rose	3	3	½	Water.
Aloes et Myrrhæ . . . . . aloes	13	13	2	
myrrh	6	6	1	
arom. powder	4	4	¾	Syrup.
Antimonii Comp. . . . . . antimony, sulphurated	4	4	¾	
(Plummer's Pills) mild mercurous chlor.	4	4	¾	
guaiac	8	8	1½	Castor oil.
Asafœtidæ . . . . . asafœtida	20	20	3	Soap.
Catharticæ Comp. . . . . . ext. colocynth comp.	8	8	1½	
mild mercurous chloride	6	6	1	
extract of jalap	3	3	½	
gamboge	1.5	1.5	¼	Water.
Catharticæ Vegetabiles . . . ext. colocynth comp.	6	6	1	
exts. hyoscyam., jalap, each	3	3	½	
ext. leptandra, res. podophyll.	1.5	1.5	¼	
oil peppermint	0.8	0.8	⅛	Water.
Ferri Carbonatis . . . . . ferrous sulphate	16	6	1	
(Ferruginous, Chalybeate, Blaud's) potass. carb.	8			
sugar 4; tragac., althæa, each	1	. .	.	Glyc. water.
Ferri Iodidi[1] . . . . . reduced iron	4	6	1	
iodine	5			
glycyrrh., sugar, each	4			
ext. glycyrrh., acacia, each	1	. .	. .	Water.
Opii . . . . . soap 2; opium pulv.	6.5	6.5	1	"
Phosphori[2] . . . . . phosphorus	0.06	0.06	1/100	
althæa, acacia, each	6	. .	. .	Glyc. water.
Rhei . . . . . soap 6; rhubarb	20	20	3	Water.
Rhei Comp. . . . . . rhubarb	13	13	2	
aloes	10	10	1½	
myrrh	6	6	1	
oil peppermint	0.5	. .	. .	"

Unofficial Pills of the National Formulary.

When a large number of pills are to be prepared in accordance with the given proportions, and the quantities of the ingredients are to be determined by multiplying with the number of pills required, it is recommended that the nearest whole number, or nearest convenient fraction, in each case, be chosen.

Pilulæ—

Ad Prandium (Dinner Pills).—When "Dinner Pills," under this or some other equivalent name, are prescribed without further specification, the National Formulary recommends that the Pilulæ Aloes et Mastiches of the U. S. P., also called "Lady Webster's Dinner Pills," be dispensed.

[1] Coated with ethereal solution of Balsam Tolu. [2] Phosphorus dissolved in Chloroform.

Pilulæ—

Of other combinations bearing similar names or used for similar purposes, the following appear to be those most commonly in use:

Chapman's Dinner Pill.—Aloes, Mastic, each, grains 1½ (0.1); Ipecac, grain 1 (0.06); Oil of Fennel, grain ¼ (0.015).

Cole's Dinner Pill.—Aloes, Mass of Mercury, and Jalap, each, grains 1½ (0.075); Ant. and Potas. Tartrate, grain $\frac{1}{50}$ (0.0013).

Hall's Dinner Pill.—Aloes, Ext. of Glycyrrhiza, Soap, and Molasses, each, grain 1 (0.06).

ALOES ET PODOPHYLLI COMPOSITÆ (Janeway's Pills).—Aloes, grain 1 (0.06); Resin Podophyllum, grain ½ (0.03); Ext. Bellad. Alc., Ext. Nux Vomica, each, grain ¼ (0.015).

ALOINI COMPOSITÆ.—Aloin, grain ½ (0.03); Resin Podophyllum, grain ⅛ (0.01); Ext. Belladonna, grain ¼ (0.015).

ALOINI, STRYCHNINÆ ET BELLADONNÆ.—Aloin, grain ⅕ (0.01 Gm.); Strychnine, alkaloid, grain $\frac{1}{120}$ (0.0005 Gm.); Alcoholic Extract of Belladonna, grain ⅛ (0.008 Gm.).

ALOINI, STRYCHNINÆ ET BELLADONNÆ COMPOSITÆ.—Aloin, grain ⅕ (0.012); Ext. Bellad. Alc., grain ⅛ (0.008 Gm.); Strychnine, alkaloid, grain $\frac{1}{120}$ (0.0005); Ext. Rham. Pursh., grain ½ (0.03).

ANTIDYSPEPTICÆ.—Strychnine, alkaloid, grain $\frac{1}{40}$ (0.0014); Ipecac, Ext. Bellad. Alc., each, grain $\frac{1}{10}$ (0.006); Mass of Mercury, Ext. Colocynth. Comp., each, grains 2 (0.13).

ANTINEURALGICÆ.—1. *Gross' Antineuralgic Pills:* Quinine Sulphate, grains 2 (0.13); Morphine Sulphate, grain $\frac{1}{10}$ (0.003); Strychnine, alkaloid, grain $\frac{1}{30}$ (0.002); Arsenous Acid, grain $\frac{1}{20}$ (0.003); Ex. Aconite Leaves (U. S. P. 1870), grain ½ (0.03).

When "Antineuralgic Pills," or "Neuralgia Pills," without other specifications, are prescribed, it is recommended that the above preparation be dispensed. Sometimes the Morphine is directed to be omitted.

2. *Brown-Séquard's Antineuralgic (or Neuralgia) Pills:* Extracts of Hyoscyamus and Conium, each, grain ⅜ (0.04); Extracts of Ignatia and Opium, each, grain ½ (0.03); Ext. Aconite Leaves, grain ⅓ (0.02); Ext. Stramonium, grain ⅛ (0.01); Ext. Indian Cannabis, grain ¼ (0.015); Ext. Bellad. Alc., grain ⅙ (0.01).

Pilulæ—

ANTIPERIODICÆ (Warburg's Pills).—1. *With Aloes:* Aqueous Extract of Aloes, grain 1 (0.06); Rhubarb, grain ½ (0.03); Elecampane, Saffron, Fennel, each, grain ¼ (0.015); Zedoary, Cubebs, Myrrh, White Agaric, Camphor, each, grain ⅛ (0.008); Quinine Sulphate, grains 1⅔ (0.085); Extract of Gentian, a sufficient quantity.

2. *Without Aloes:* The same formula as above, with omission of the Aqueous Extract of Aloes. These pills have been introduced for the purpose of facilitating the administration of Warburg's Tincture in a solid form. When "Warburg's Pills" or "Pills of Warburg's Tincture" are prescribed, without further specification, those containing Aloes are recommended to be dispensed—those without Aloes only when they are expressly demanded.

Each Warburg's Pill represents about 1 fluidrachm (4 Cc.) of Warburg's Tincture. (See *Tinctura Antiperiodica.*)

COLOCYNTHIDIS COMPOSITÆ (Pilulæ Cochia).—Extract of Colocynth, grain ⅙ (001); Aloes, Resin of Scammony, of each, grains 2 (0.13); Oil of Cloves, min. ¼ (0.015).

COLOCYNTHIDIS ET HYOSCYAMI.—Extract of Colocynth, grain 1/10 (0.006); Aloes, Resin of Scammony, Ext. Hyoscyamus, each, grains 1½ (0.1); Oil of Cloves, min. ⅙ (0.01).

COLOCYNTHIDIS ET PODOPHYLLI.—Compound Extract of Colocynth, grains 1½ (0.16); Resin of Podophyllum, grain ¼ (0.015).

FERRI COMPOSITÆ (U. S. P. 1880).—Myrrh, 1½ grains (0.1); Ferrous Sulphate, Sodium Carbonate, each, ¾ grains (0.048).

GALBANI COMPOSITÆ (U. S. P. 1880).—Galbanum, Myrrh, each, 1½ grains (0.1); Asafœtida, ½ grain (0.03).

GLONOINI (Nitroglycerin).—Spirit of Glonoin (1 per cent.), Athæa, each, grains 200 (13.0); Confection of Rose, a sufficient quantity. Make a mass and divide it into two hundred (200) pills. Each pill contains 1/100 grain (0.0007) of Glonoin (Nitro-glycerin).

LAXATIVÆ POST-PARTUM (Barker's).—Ext. Colocynth. Comp., grains 1⅔ (0.1); Aloes, grain ⅚ (0.05); Res. Podoph., Ipecac., each, 1/12 grain (0.005); Ext. Nux Vomica, 5/12 grain (0.03); Ext. Hyoscyamus, 1¼ grains (0.8).

This is the formula generally employed by Dr. Fordyce Barker, except where special circumstances render modi-

Pilulæ—

fications necessary. The formula usually quoted in manufacturers' lists and some formularies is not correct.

METALLORUM (Metallorum Amaræ).—Reduced Iron and Quinine Sulphate, each, grain 1 (0.06); Strychnine and Arsenous Acid, of each, grain $\frac{1}{20}$ (0.003).

Aitken's Tonic Pill is a similar combination:

Reduced Iron, grain $\frac{2}{3}$ (0.04); Quinine Sulphate, grain 1 (0.06); Strychnine, Arsenous Acid, each, grain $\frac{1}{60}$ (0.0012).

OPII ET CAMPHORÆ.—Powdered Opium, 1 grain (0.06); Camphor, grains 2 (0.13).

OPII ET PLUMBI.—Powdered Opium and Acetate of Lead, each, grain 1 (0.06).

PODOPHYLLI, BELLADONNÆ ET CAPSICI (Squibb's Podophyllum Pills).—Resin Podophyllum, grain $\frac{1}{4}$ (0.015); Capsicum, grain $\frac{1}{2}$ (0.03); Ext. Bellad. Alc., grain $\frac{1}{8}$ (0.008); Sugar of Milk, grain 1 (0.06); Acacia, Glycerin, and Syrup, each, a sufficient quantity.

QUADRUPLICES (Ferri et Quininæ Compositæ).—Ferrous Sulphate, Quinine Sulphate, Aloes, each, grain 1 (0.06); Ext. Nux Vomica, grain $\frac{1}{4}$ (0.015); Ext. Gentian, sufficient.

TRIPLICES (Triplex).—Aloes, grains 2 (0.13); Resin Podophyllum, grain $\frac{1}{4}$ (0.015); Mass of Mercury, grain 1 (0.06).

When Pilula Triplex, under this name or some equivalent, is prescribed without further specification, the N. F. recommends that the above preparation be dispensed. A formula devised by John W. Francis is also in use:

2. *Francis's Triplex Pill.*—Aloes, Scammony, Mass of Mercury, of each, grain $\frac{5}{6}$ (0.05); Croton Oil, $\frac{1}{20}$ min. (0.003); Oil of Caraway, grain $\frac{1}{4}$ (0.015); Tincture of Aloes and Myrrh, a sufficient quantity.

UNOFFICIAL FORMS OF MIXTURES OF SOLIDS FOR INTERNAL USE.

Granules are small pills, less than 1 grain (0.06) in weight, usually sugar-coated and containing alkaloids and other active drugs.

Parvules are identical with granules. They are usually colored red or pink.

Globules (*Orbiculæ*) are sugar pellets to be saturated with alcoholic solutions of medicinal agents, chiefly in Homœopathy.

Compressed Pills are made by compressing powders into disks not exceeding 5 grains (0.3) in weight, without any excipient.

Friable Pills are made by aggregation, spreading the powdered mixture upon nuclei or sugar granules in a revolving pan until the pills are formed.

Bolus is the name given to pills exceeding 5–10 grains (0.3–0.6) in weight, used in veterinary practice. A sugar-coated bolus is called a Dragee.

Rotulæ are disk-shaped forms of sugar about 1½ grains (0.1) in weight, which may be flavored with alcoholic solution (spirits).

Bacilli are cylindrical sticks, a form of lozenge (Licorice).

Lamellæ, thin squares of gelatin in which the active agent has been incorporated, intended for solution in the eye.

PREPARATIONS FOR EXTERNAL USE.

To this group belong the *liquid* preparations: Liniments, Oleates and Collodions, and the mixtures of *solids:* Ointments, Cerates, Suppositories, Plasters, and Papers. The Vehicle, sometimes incorrectly called the "base," consists chiefly of fatty substances which serve as protectives or facilitate absorption. The Collodions are, however, an exception.

The solid mixtures may be classified according to their *fusibility*, or melting-points, because their therapeutic uses, as well as their pharmaceutical forms, are through this quality respectively determined.

Ointments fuse at the body-temperature, and therefore produce an emollient effect, or induce *absorption* of the medicinal substance by the system. They are applied by rubbing or inunction.

Cerates have a higher fusing-point, due to Wax they contain; the medicinal agent is not so readily absorbed, and they are therefore used to produce *local* effects, being spread on cloth and applied as *dressings*.

Suppositories have the same fusibility as cerates, and may be said to be cerates intended for application to the *orifices* of the body, both for absorption and local effect.

Plasters have a still higher fusibility; they do not melt, but become *adhesive* by the body-temperature, and are intended to produce *local* effects and afford *mechanical support* to the parts affected.

The fusibilities of these various preparations are likewise governed by the respective vehicles employed.

LINIMENTA—LINIMENTS.

The Liniments are liquid preparations for external use, consisting of solutions of *oily* or *resinous* constituents in Alcohol or Oils, or mixtures of liquid Soaps. The nine official Liniments are prepared by simple admixture or solution.

Linimentum—

Ammoniæ . . cotton seed oil 60 Cc.; ammonia water 35 Cc.; alcohol 5 Cc.

Belladonnæ . . . fl. ext. belladonna 95 Cc.; camphor 5 Gm.

Calcis (Carron Oil) . . linseed oil 50 Cc.; lime solution 50 Cc.

Camphoræ . . . . cotton seed oil 80 Gm.; camphor 20 Gm.

Chloroformi . . . . soap liniment 70 Cc.; chloroform 30 Cc.

Saponis . . . . . camphor 4.5, soap 7, rosemary oil 1; alcohol 75; water, to 100 Cc.

Saponis Mollis, alcohol 35 Cc.; lavender oil 2; soft soap 65 Gm.

Sinapis Comp. . . . fl. ext. mezereum 20; mustard oil, vol. 3, camphor 6; castor oil 15; alcohol, to 100 Cc.

Terebinthinæ . . resin cerate 65 Gm.; turpentine oil 35 Gm.

Unofficial Liniments of the National Formulary.

Linimentum—

ACONITI ET CHLOROFORMI.—Tincture of Aconite, Chloroform, each, 2 fluidounces (60 Cc.); Soap Liniment, 12 fluidounces (355 Cc.).

AMMONII IODIDI.—Iodine, 30 grains (2.); Oil of Rosemary, Oil of Lavender, each, 110 minims (7 Cc.); Camphor, 220 grains (15.); Water of Ammonia, 1¾ fluidounces (50 Cc.); Alcohol, enough to make 16 fluidounces (473.17 Cc.). On standing, it becomes colorless.

CANTHARIDIS (U. S. P. 1880).—Oil of Turpentine containing 15 per cent. of Cantharides.

IODI (similar to Ph. Br.).—Iodine, 900 grains (60.); Potassium Iodide, 360 grains (24.); Glycerin, ½ fluidounce (15 Cc.); Water, 1 fluidounce (30 Cc.); Alcohol, enough to make 16 fluidounces (473.17 Cc.).

OPII COMPOSITUM (Canada Liniment).—Tincture of Opium, 1½ fluidounces (45 Cc.); Camphor, 120 grains (8.); Alcohol, 4 fluidounces (118 Cc.); Oil of Peppermint, 180 minims

Linimentum—

(12 Cc.); Water of Ammonia, 6 fluidounces (180 Cc.); Oil of Turpentine, enough to make 16 fluidounces (473.17 Cc.).

PLUMBI SUBACETATIS (U. S. P. 1880).—Solution of Lead Subacetate, 35 parts; Cotton Seed Oil, 65 parts.

SAPONATO-CAMPHORATUM (Opodeldoc; Solid Opodeldoc).—White Castile Soap, 1½ ounces (45.); Camphor, ½ ounce (15.); Alcohol, 20 fluidounces (592 Cc.); Oil of Thyme, 30 minims (2 Cc.); Oil of Rosemary, 60 minims (4 Cc.); Water of Ammonia, Fort., 1 fluidounce (30 Cc.).

TEREBINTHINÆ ACETICUM (Linimentum Album., Stokes' Liniment; St. John Long's Liniment).—Oil of Turpentine, 3 fluidounces (89 Cc.); Fresh Egg, 1; Oil of Lemon, 60 minims (4 Cc.); Acetic Acid, 300 minims (20 Cc.); Rose Water, 2½ fluidounces (75 Cc.).

TIGLII (Linimentum Crotonis, Ph. Br.).—Croton Oil, 2 fluidrachms (8 Cc.); Oil of Cajuput, 7 fluidrachms (27.5 Cc.).

TIGLII COMPOSITUM.—Croton Oil, 1 fluidounce (30 Cc.); Oil of Sassafras, 1 fluidounce (30 Cc.); Oil of Turpentine, 1 fluidounce (30 Cc.); Oil of Olive, 2 fluidounces (60 Cc.).

LOTIONES—WASHES.

Lotio—

ADSTRINGENS (Warren's Styptic).—A mixture of Sulphuric Acid, Oil of Turpentine, and Alcohol.

FLAVA (Yellow Wash, Aqua Phagedænica Flava, Ph. Ger.).—Corrosive Mercuric Chloride, 24 grains (1.5), in Lime Water, 16 fluidounces (473 Cc.).

NIGRA (Black Wash; Aqua Phagedænica Nigra, Ph. Ger.).—Mild Mercurous Chloride, 64 grains (4.), in Lime Water, 16 fluidounces (473 Cc.).

PLUMBI ET OPII (Lead-and-Opium Wash).—Lead Acetate, 120 grains (8.); Tincture of Opium, ½ fluidounce (15 Cc.); in Water, 16 fluidounces (473 Cc.). To be shaken when dispensed.

The following are unofficial solutions and mixtures for external use:

Injectio, -ones.—Aqueous solutions for introduction by means of a syringe in the orifices of the body.

Injectio Hypodermica.—Solution for hypodermic or subcutaneous injection.

Enema, -atis; Clyster.—A warm solution of Soap or a mucilaginous mixture for injection in the rectum to produce evacuation, or for nutrition.

Gargarisma, -atis; Gargle.—A wash or lotion for the throat.

Collyrium, -i; "Eye-wash."—A weak solution for instillation in the eyes.

Nebula, -æ; Spray.—A liquid intended for application by means of an atomizer.

Vapor, -oris; Inhalation.—Volatile agents to be added to boiling water and inhaled, to affect the air-passages.

Balneum, -ei; Bath.—Mixture to be added to water for bathing purposes.

OLEATA—OLEATES.

The official Oleates are solutions of oleates in Oleic Acid. They are distinct from the solid oleates, which are made by double decomposition of salts of the metals and alkaline earths and sodium oleate, or Soap. (See *Soap.*)

The *liquid* Oleates are intended for endermic medication. They are applied by inunction, when the Oleic Acid favors the absorption of the medicinal agent, the oleate in solution. When it is not desirable to administer remedies by the mouth, the Oleates afford an effective form of medication.

The *solid* Oleates are either dry powders, well adapted for protectives as dusting powders, or soft, pliable masses to be applied in the form of ointments or plasters.

Three are official—two liquid, and one, Zinc Oleate, semi-solid. They are made by incorporating the solid with the Oleic Acid, contained in a warm mortar, and effecting solution with a gentle heat:

		Percentage by weight.
Oleatum Hydrargyri	yellow mercuric oxide	20.
Oleatum Veratrinæ	veratrine	2.
Oleatum Zinci Oxidi	zinc oxide	5.

Unofficial Oleates of the National Formulary.

The following are simply solutions of the alkaloids in Oleic Acid:

Oleatum—

ACONITINÆ.—Contains 2 per cent. of crystallized Aconitine (Duquesnel's).

QUININÆ.—Contains 25 per cent. of Quinine (Alkaloid).

Of the solid Oleates introduced by Dr. J. V. Shoemaker, the following have been recognized, but others may also be prepared as desired:

OLEATUM PLUMBI.—Contains about 28 per cent. of Lead Oxide. It is of the consistence and general character of Lead Plaster, and suggests similar use.

OLEATUM ZINCI.—In the form of a soft white powder, useful as a "dusting powder," or converted into a plaster or ointment by mixing it with such proportion of Oleic Acid as may be required.

OLEA INFUSA—INFUSED OILS.

These preparations are obtained by infusing a dry herb, usually from the so-called narcotic plants, in five times its weight of a mixture of equal parts of Cotton Seed Oil and Lard Oil. *Oleum Hyoscyami Infusum* is the most familiar example.

Oleum—

CARBOLATUM.—A mixture of Cotton Seed Oil with 5 per cent. of Carbolic Acid.

HYOSCYAMI COMPOSITUM (Balsamum Tranquillans).—Infused Oil of Hyoscyamus, with a small proportion of each of the Ethereal Oils of Absinth, Lavender, Rose, Sage, and Thyme.

COLLODIA—COLLODIONS.

The Collodions are solutions in Ether-Alcohol of Pyroxylin or Soluble Gun Cotton. Upon evaporation of the solvent the remaining film excludes the air, thus protecting abraded surfaces. Collodion is also used as a vehicle when a prolonged local effect is desired.

The following forms are official:

Collodium . .	solution in ether 75; alco. 25;	pyroxylin 3
Collodium Flexile . . .	castor oil 3;	Canada turpentine 5
Collodium Acidi Tannici . .	alco. 5; ether 25;	acid tan. 20
Collodium Cantharidatum (Blistering Collodion) .	(flex. collo.)	cantharides 60

Unofficial Collodions.

Collodium—

IODATUM (Iodized Collodion).—Contains 5 per cent. Iodine in Flexible Collodion.

IODOFORMATUM (Iodoform Collodion).—Contains 5 per cent. Iodoform in Flexible Collodion.

SALICYLATUM COMPOSITUM (Corn Collodion).—Contains 11 per cent. Salicylic Acid and 2 per cent. Ext. Cannabis Indica in Flexible Collodion.

TIGLII (Croton Oil Collodion).—Contains 10 per cent. Croton Oil in Flexible Collodion.

UNGUENTA—OINTMENTS.

Ointments are mixtures of a fatty vehicle with which medicinal agents are incorporated, readily fusing at the body-temperature, 35° to 40° C. (95° to 104° F.).

The *vehicles* used are: Benzoated Lard, Ointment (simple), Lard, and Wax or Spermaceti in different proportions, Lard Oil, Olive Oil, and Suet. Petrolatum and Wool-fat (*Adeps Lanæ Hydrosus*, U. S. P.) are employed in unofficial ointments.

The medicinal ingredients must be minutely distributed through the vehicle in order that the ointment may not prove irritating, and that the greatest possible surface be presented to the epidermis with a view to quick and uniform absorption. For this reason the highest quality of an ointment (next to its proper melting-point) is *smoothness*. In the preparation of ointments care must therefore be taken that the method employed be such as to yield *smooth* products.

The melting-point is governed by the fusibility of the vehicle used, which is either officially directed, as in official preparations, or in extemporaneous preparations prescribed by the physician.

The twenty-three official Ointments are prepared (1) by mechanical admixture, (2) by fusion, or (3) by chemical reaction.

Mixing the medicinal substances with the fatty body in a mortar or on a slab is the process usually employed for solid substances, especially when insoluble in the fat. Powdered drugs, acids, alkaloids, extracts, and salts (not attended by chemical union) are examples adapted to this process.

following points must be observed:

s must be in a fine powder before being incorporated with le; sometimes it is an advantage to triturate the solid with

a small quantity of a bland fixed oil, as Almond Oil or Olive Oil, into a smooth cream before it is mixed with the vehicle proper—Lard, etc.

Extracts should be reduced to a semi-liquid condition by trituration with a little dilute Alcohol or Water. Substances soluble in fats, such as Carbolic Acid, Iodine, and Camphor, may be dissolved directly in the fat by the aid of a gentle heat.

The following are the official Ointments, with their drug-strengths, their respective vehicles being given in parentheses:

Unguentum—	*Percentage of Drugs.*
Acidi Carbolici . . . . . (ointment)	5
Acidi Tannici . . . . . (benz. lard)	20
Aquæ Rosæ (Cold Cream) . . spermaceti 12.5; white wax, 12; expressed oil of almond	60
then incorporate borax 0.5; rose water	19
Belladonnæ (dil. alcohol 5) extract . . . (benz. lard)	10
Chrysarobini (chrysophanic acid) . . . . . "	5
Diachylon (Hebra's) . . . . . lead plaster	50
oil lavender 1; olive oil	49
Gallæ . . . . . (benz. lard)	20
Hydrargyri (Blue Ointment) . . . . . mercury	50
mercuric oleate 2; suet 23; lard	25
Hydrargyri Ammoniati . . . . . (benz. lard)	10
Hydrargyri Oxidi Flavi . . . . . (ointment)	10
Hydrargyri Oxidi Rubri (castor oil 5) . . . "	10
Iodi (potass. iod. 1, water 2 parts) . . . . (benz. lard)	4
Iodoformi . . . . . "	10
Picis Liquidæ . . . yellow wax 12.5; lard 37.5; tar	50
Plumbi Carbonatis . . . . . (benz. lard)	10
Plumbi Iodidi . . . . . "	10
Potassii Iodidi (sod. hypo. sulph. 1; water 10) "	12
Stramonii (dil. alc. 5) Extract . . . . . "	10
Sulphuris (washed) . . . . . "	30
Veratrinæ (olive oil 6) . . . . . "	4
Zinci Oxidi . . . . . "	20

Unofficial Ointments of the National Formulary.

UNGUENTUM ACIDI GALLICI (U. S. P. 1880).—Contains 10 per cent. Gallic Acid.

UNGUENTUM CALAMINÆ (Unguentum Zinci Carbonatis Impuri; Turner's Cerate).—Contains 17 per cent. Zinc Carbonate (Imp.).

UNGUENTUM CAMPHORÆ (Unguentum Camphoratum).—Contains 20 per cent. Camphor.

UNGUENTUM FUSCUM (Unguentum Matris; Mother's Salve).—Contains 50 per cent. of Camphorated Brown Plaster (N. F.).

UNGUENTUM MEZERII (U. S. P. 1880).—Represents 25 per cent. Mezereum.

UNGUENTUM PICIS COMPOSITUM (Tar, Comp.).—Contains Oil of Tar, 4 per cent.; Tincture of Benzoin, 2 per cent.; and Oxide of Zinc, 3 per cent.

UNGUENTUM SULPHURIS ALKALINUM (U. S. P. 1880).—Contains 20 per cent. Sulphur and 10 per cent. Potassium Carbonate.

UNGUENTUM SULPHURIS COMPOSITUM (Wilkinson's Ointment; Hebra's Itch Ointment).—Precipitated Calcium Carbonate, 10; Sublimed Sulphur, Oil of Cade, of each, 15; Soft Soap and Lard, of each, 30 parts. The Lard is mixed with the Soft Soap and Oil of Cade; the Sublimated Sulphur and Precipitated Calcium Carbonate are then gradually incorporated.

CERATA—CERATES.

Cerates are mixtures of fats similar to the ointments, but of firmer consistence, because they contain Wax or Resin (having a higher melting-point than Lard) in greater proportion than do ointments. In the preparation of Cerates the same rules are to be observed as noted under Ointments.

The six official Cerates are prepared by fusion or simple admixture, and one by extraction and digestion (Ceratum Cantharidis):

	Percentage of Drugs.
CERATUM (Simple) . . . . . lard 70; white wax	30
Camphoræ . camphor liniment 10; lard 60; white wax	30
Cantharidis (Blistering Cerate) . . . oil of turpentine	15
lard, 22; cantharides	32
yellow wax, resin, each	18
previously fused, and evaporate to	100
Cetacei . . . olive oil 55; white wax 35; spermaceti	10

		Percentage of Drugs.
Plumbi Subacetatis (Goulard's Cerate),	camphor cerate	80
	solution lead subacetate	20
Resinæ (Basilicon) . .	yellow wax 15 lard 50; resin	35
	in cold weather yellow wax 12; lard 53; resin	35

In the "Blistering Cerate" the maceration in Turpentine Oil and subsequent digestion dissolve the vesicating principle of the Cantharides, and the preparation is therefore more active.

CERATUM CAMPHORÆ COMPOSITUM, N. F. (Camphor Ice).—Moulded into small cakes suitable for popular use as an application to excoriated surfaces. It contains very small quantities of Benzoic and Carbolic Acids.

CERATUM EXTRACTI CANTHARIDIS (U. S. P. 1880).—Represents 30 per cent. Cantharides.

CERATUM SABINÆ (U. S. P. 1880).—Represents 25 per cent. Sabine.

SUPPOSITORIA—SUPPOSITORIES.

Suppositories may be defined as variously shaped masses of medicated fat, possessing a consistence ensuring their quick fusion when introduced in the orifices of the body.

The U. S. P. defines Suppositories with reference to their *weights* and *shapes*, corresponding to their several uses—*i. e.* for introduction in the respective orifices of the body—as follows:

Rectal, cone-shaped, should weigh 15 grains (1 Gm.).

Urethral, pencil-shaped, should weigh 15 grains (1 Gm.).

Vaginal, globular, should weigh about 45 grains (3 Gm.).

The vehicle is Cacao Butter (*Oleum Theobromatis*), which possesses the property of melting at the temperature of the human body, 35° C. (95° F.), and yet remaining firm at ordinary temperatures. An addition of 10 per cent. of spermaceti has been recommended to raise the melting-point and thus give more stability to suppositories during the heated seasons of the year.

The U. S. P. gives a general formula for preparing suppositories; only one Suppository is official, and this is not made from Cacao Butter.

The *methods* of preparing suppositories are quite numerous: any process may be employed by which the product is obtained uniform in size and shape and with the medicinal ingredients thor-

oughly incorporated. Moulds are usually employed; the medicinal ingredients, if solid, are first reduced to powder in a mortar, and mixed with a small quantity of the grated Fat; the remainder of the Fat, previously melted and cooled to 35° C., is then gradually incorporated with this mixture, thoroughly mixed, and, if possible, without further heating, poured into the moulds, previously chilled.

Another process consists in rolling the mass on a slab, cutting it as in making pills, and forming the cones with the fingers. By cold compression in a screw-press "machine," suppositories may be formed from the prepared mass.

Urethral Suppositories are commonly called *Bougies*, or, more properly, Medicated Bougies. They are usually made with the addition of Wax, or from Glyco-gelatin mass.

Suppositoria Glycerini.—Made by reaction of Sodium Carbonate 5 grains (0.3), in Glycerin 1½ grains (6 Gm.), with Stearic Acid 8 grains (0.5), and heating until a solution of *sodium stearate* or soap is formed, which is poured into a mould. Upon cooling, the mixture gelatinizes and the suppository is wrapped in tin-foil.

Uses.—Upon introduction into the rectum the mass melts, and the Glycerin, acting upon the feces, produces evacuation.

Rectal suppositories are usually made twice the official size, or 30 grains (2 Gm.).

A formula for suppositories would be:

Extracti Belladonnæ Fol., alc., 0.1;
Acidi Tannici, 1.0;
Olei Theobromatis, q. s. (20 Gm.).
Fiant suppositoriæ No. x. (2 Gm.).

Each suppository would contain ⅛ grain (0.01) Ext. Belladonna and 1½ grains (0.1) Tannic Acid.

EMPLASTRA—PLASTERS.

Plasters are mixtures of various fatty or resinous solids of such high melting-point as to be friable when cold, but rendered *adhesive* by the warmth of the body.

The *vehicles* of plasters are: Lead plaster; resinous substances, made adhesive by admixture with the medicinal ingredients; and simple plasters, such as isinglass.

The *making* of plasters does not differ materially from the process employed for ointments and cerates, since they are all prepared by melting the various substances and incorporating the medicinal

substances last. The *spreading* of plasters, though usually done on a large scale, may be easily effected by the pharmacist with the use of a plaster iron.

The thirteen official Plasters may be divided into—(1) Lead Plasters; (2) Pitch and Gum-Resin Plasters, and (3) Isinglass Plaster.

(1) The most important plasters are made from Lead Plaster, or Lead Plaster mixed with Resin, the official Resin Plaster.

Emplastrum—		*Percentage or parts in 100.*
Plumbi (Diachylon)	olive oil 60; lead oxide mix, and add to water	32 10
	Boil the mixture until the reaction has ceased and the plaster is of the right consistence, replacing water lost by evaporation from time to time.	
Resinæ (Adhesive)	yellow wax 6; resin lead plaster	14 80
Saponis	lead plaster 90; soap	10

From these the following are prepared:

Emplastrum—		
Arnicæ	resin plaster 67; extract arnica root	33
Belladonnæ	ext. belladonna leaves resin plaster, soap plaster, each	20 40
Capsici . . .	resin plaster, oleoresin capsicum q. s.	
Hydrargyri, lead plaster 70; mercury oleate 1.2; mercury		30

Containing lead plaster and pitch:

Emplastrum—		
Ferri (Strengthening) . . .	olive oil, 5; ferric hydrate Burgundy pitch 14; lead plaster	9 72
Opii . Burgundy pitch 18; lead plaster 76; ext. opium		6
Picis Cantharidatum (Warming) . . .	Burgundy pitch cerate cantharides	92 8

(2) Pitch and Gum Resin Plasters:

Emplastrum—		
Ammoniaci cum Hydrargyro	oleate mercury mercury ammoniac 72; dil. acetic acid, lead plaster, to	0.8 18 100
Picis Burgundicæ	olive oil 5; yellow wax Burgundy pitch	15 80

(3) Isinglass plaster (Emplastrum Ichthyocollæ; Court-plaster).—A solution of 10 Gm. Isinglass is dissolved in hot Water 120 Gm.; one-half of the solution is spread upon silk (taffeta) in successive layers, and when dry the other half of the solution is spread on in a similar manner, after first having been mixed with Alcohol 40 Gm., Glycerin 1 Gm. The taffeta is then coated on the reversed side with Tincture of Benzoin to make it waterproof and antiseptic.

Unofficial Plasters of the National Formulary.

Emplastrum—

AMMONIACI (U. S. P. 1880).—Gum-resin Ammoniac with Acetic Acid.

AROMATICUM (Spice Plaster).—Consisting of Cloves, Cinnamon, and Ginger, each, 10 per cent.; Capsicum and Camphor, each, 5 per cent.

ASAFŒTIDÆ (U. S. P. 1880).—Asafœtida 35 p.; Galbanum 15 p.; with Lead Plaster.

FUSCUM CAMPHORATUM (Matris Camphoratum, Ph. Ger.).—Camphorated Mother's Plaster. A plaster similar to lead plaster, and containing camphor, 1 per cent.

GALBANI (U. S. P. 1880).—Galbanum Plaster.

PICIS CANADENSIS (U. S. P. 1880).—Canada Pitch Plaster.

PICIS LIQUIDÆ COMP.—A mixture of Resin and Tar, with Podophyllum, Phytolacca, and Sanguinaria, of each, 10 per cent.

CHARTÆ—PAPERS.

There are two Papers official. One is made by saturating strips of white unsized paper in a 20 per cent. solution of Potassium Nitrate and drying; the other is paper coated with Mustard, used similarly to the Plasters:

Charta Potassii Nitratis . . . . potass. nitrate 20; water 80. Vapors from incineration as inhalant.

Charta Sinapis . . oil-free black mustard, 4 Gm. in 60 sq. cm.

The Mustard is freed from the fixed oil by extraction with Benzin, and mixed with a solution of India Rubber in equal volumes of Benzin and Carbon Disulphide, and spread upon Paper. This is the well-known Mustard Plaster or Mustard Paper. When applied, the paper should be immersed in lukewarm water for a few minutes, in order to render the vesicating principle active.

CHARTA CANTHARIDIS, U. S. P. 1880.—Cantharidis Paper (Blistering Paper).

Poultice or Cataplasm (Lat. *Cataplasma, -atis*).—A coarsely ground substance or mixture of substances, such as flaxseed or elm-bark, made into a mass with hot water or some other liquid, spread upon cloth or filled into porous bags, and applied to the body while hot.

Fomentations (Lat. *Fomentum, -i*).—Porous woollen cloths saturated with hot infusion or decoction of herbs, or other hot liquids or lotions, and applied hot.

Spongiopiline.—A thick cloth covered with layers of sponge for the saturation and retention of medicinal agents intended for absorption, the exterior being composed of waterproof material, such as rubber.

Plaster-Mull.—A thin cloth made impervious with rubber or gutta-percha tissue, upon which is spread or painted medicinal agents in the liquid form, intended for local application.

Caustics or Escharotics (Gr. *Escharotikos*).—Substances used to destroy tissue by chemical action or by heat, either semi-solid mixtures made into a *paste* with starch or other diluent, or chemicals fused and moulded into sticks called *pencils* or "crayons" (Lat. *stilus, -i*), to be applied directly to the skin. *Moxa* is the name given to small cones of combustible substances which upon incineration do not inflame, but give off an intense heat, used for cauterization when heat is desired.

Bandages; Antiseptic Dressings.—The material used for bandages is cellulose in various modifications, such as cotton, linen, jute, and other fibrous substances. Aside from the mechanical support afforded, bandages also serve to keep wounds clean by absorbing and withdrawing secretions (pus) which would otherwise prove irritating, and by protecting them against extraneous matter serve to promote the healing process.

These various substances may be used either plain or medicated, when they are called *antiseptic*.

Gossypium Purificatum, U. S. P.; Absorbent Cotton.—The hairs of *Gossypium herbaceum* L., freed from oil and resinous substances by treatment with alkalies and bleaching agents. These hairs represent microscopic ducts in which liquids are absorbed through capillarity. The freer from oily constituents, the more readily will watery liquids be taken up and retained; hence the absorbability of cotton depends upon its purity. This is equally true with all other bandage material.

Linen in the form of thin sheets, known as Muslin or Muslin-

gauze, or purified similarly to cotton, when it is called *Lint*, is made from the bast-fibres of the *Linum usitatissimum* L., Flax. Hemp and Jute are the bast-fibres of their respective plants.

Medicated Dressings.—These are made by saturating the material or vehicle in a solution of certain strength of the medicinal agent, or incorporating the latter in powdered form. In the application of a dressing which has been rendered aseptic or antiseptic by impregnating it with Phenol (Carbolic Acid), Salicylic Acid, Mercuric Chloride, or similar agent, it is desired to bring in contact with the wound a solution of certain strength—for example, a 5 or 10 per cent. solution of Phenol, a $\frac{1}{10}$ or $\frac{1}{20}$ of 1 per cent. solution of Mercuric Chloride, etc. The quantity of material which conveys the agent is of no consequence, as the fabric simply serves as a vehicle for the medicinal or antiseptic agent. The strengths of such dressings should therefore be designated by the *percentage-strength of the solutions by which they are saturated*, rather than by the percentage by weight of the medicinal agent the finished dressing may contain.

In dressings of antiseptic agents that are usually applied in substance, such as Boric Acid and Iodoform, the percentage-amount actually contained by weight in the finished dressing should be stated. Here the use of a vehicle is only a matter of convenience, and it is desirable to know just how much of the medicinal agent is contained in a certain quantity by weight or by area of the dressing.

Medicated Cottons.—Purified cotton is saturated in a solution in Water, or Glycerin and Water, of the strength desired of the medicinal agent, and thoroughly expressed.

The following are the usual strengths:

		Percentage.
Gossypium Boratum	acid boric	5 or 10
Carbolatum	phenol	5 or 10
Iodoformatum	iodoform	10 to 20
Salicylatum	acid salicylic	10 to 20
Stypticum	Monsel's solution	
Sublimatum	mercuric chloride	$\frac{1}{10}$ to $\frac{1}{20}$

Iodoform, being insoluble in Water, should be dissolved in Ether or, preferably, in a mixture of Alcohol and Glycerin.

Medicated Gauzes; Carbasa.—The material used for making Medicated Gauzes is a muslin gauze free from sizing or other extraneous matter. The gauze is thoroughly impregnated with the

solution of the particular strength required, then forcibly expressed, after which it is ready for use; or, if desired for future use, it should be tightly rolled, wrapped in parchment paper, and kept in closely covered boxes in a cool, dry place.

The following are the most commonly used Gauzes and their strengths:

		Percentage.
Carbasus Boratum	acid boric	5–10
Carbolatum	phenol	5–10
Iodoformatum	iodoform	10–20
Salicylatum	acid salicylic	10–20
Sublimatum	mercuric chloride	$\frac{1}{20}$–$\frac{1}{10}$

The Iodoform Gauze is made in the same way as the Cotton, by saturation with a solution of Iodoform in Alcohol and Glycerin. All the others, except the Mercurial Gauze, contain Glycerin. Mercuric Chloride is dissolved in Water with a little Acid Tartaric (5 parts for 1 of Mercuric Chloride), the presence of which in the Gauze prevents the formation of insoluble albuminate of mercury when it is brought in contact with the albuminous discharges from wounds.

Plaster-of-Paris bandages are made by thoroughly incorporating Calcium Sulphate (gypsum) into linen bandages. When applied, the bandage, after being dipped in water, sets hard and firm in a few minutes.

CLASS I.—DISEASE MEDICINES.

DIVISION I.—RESTORATIVES.

GROUP I.—DIGESTANTS.

[In the present work care has been taken to designate the proper pronunciation (*Foster*) of the names of drugs and their preparations common to Materia Medica and Therapeutics. The simplest and most efficient method appears to be that herein followed—namely, to indicate accent and quantity by a single sign; for example, Pepsĭnum (nom.)—Pepsĭni (gen.), in which the *i* is long and the accent upon the second syllable; Cŏcculus—Cŏcculi, in which the *o* is short and the accent upon the first syllable.

In nearly all cases the *genitive*, as used in prescription-writing, and the *English equivalent*, are given. When the *accusative*, not genitive, is adopted, the usage is marked by "(acc.)"; as Pĭlulæ, Pĭlulas (acc.), etc.]

Pepsīnum—Pepsīni—Pepsin. *U. S. P.*

Origin.—A proteolytic ferment or enzyme obtained from the glandular layer of fresh stomachs from healthy pigs, and capable of digesting not less than 3000 times its own weight of freshly coagulated and disintegrated egg albumen when tested by the process given in the United States Pharmacopœia.

Description and Properties.—A fine white, or yellowish-white, amorphous powder, or thin, pale yellow, or yellowish, transparent or translucent grains or scales, free from offensive odor, and having a mildly acidulous or slightly saline taste, usually followed by a suggestion of bitterness. It slowly attracts moisture when exposed to the air. Soluble, or for the most part soluble, in about 100 parts of water, with more or less opalescence; more soluble in water acidulated with hydrochloric acid; insoluble in alcohol, ether, or chloroform. Pepsin usually has a slightly acid reaction. It may be neutral, but should never be alkaline.

Dose.—5–60 gr. (0.3–4.0 Gm.).

Official Preparations.

Pepsīnum Saccharātum—Pepsīni Saccharāti—Saccharated Pepsin.

Formula: Pepsin 10, Sugar of Milk 90 parts. *Dose*, 30 gr.–4 dr. (2.0–16.0 Gm.).

Antagonists and Incompatibles.—Tannic and gallic acids are incompatibles. Mineral salts, alcohol, and alkalies precipitate pepsin from solution, the two latter impairing its digestive property. The "Wine of Pepsin" is therefore unreliable.

Synergists.—Diluted hydrochloric acid, in not over $\frac{2}{10}$ of 1 per cent., increases its digestive action.

Physiological Action.—Its only influence seems to be upon the digestive system. Pepsin is a typical restorative, being a normal constituent of the gastric juice, and in the presence of hydrochloric acid digesting the proteid elements of the food, converting them into albumoses, and finally into peptones.

Therapeutics.—*Externally and Locally.*—Its digestive action is utilized to dissolve or digest the false membrane in *diphtheria* and *croup*. A solution of pepsin has also been injected into the bladder to digest blood-clots.

Internally.—As a restorative, where there is a lessened secretion of gastric juice, *atonic dyspepsia*, *apepsia* of infants, *cancer of the stomach*, and *gastric ulcer*, pepsin has proved serviceable. It is also employed to favor digestion in convalescence from acute and long illness. It is frequently necessary to give pepsin, or "peptonized milk," in acute *dyspeptic diarrhea* of infants.

Administration.—Pepsin should be given in powder or dissolved in glycerin (Glycerol of Pepsin), or in water acidulated with hydrochloric acid, directly after meals.

The drug should not be given continuously for too long a period, lest the function of the stomach become impaired from disuse, the artificial digestion having replaced the natural, normal process.

Unless there be some direct indication for its use, rather than give pepsin it is better to stimulate the gastric glands to secrete a larger amount of their normal juice, that they may not lie idle, and their function be consequently impaired by disuse. Hydrochloric acid administered with pepsin probably slightly promotes glandular activity. Often, however, pepsin must be given, and in certain cases the stomach is in such a condition that nutrient enemata must be administered. Yet, since the rectum possesses very feeble powers of digestion, foods should always be predigested. Suppositories of peptonized meat are frequently used for this purpose.

Pancreatīnum—Pancreatīni—Pancreatin. *U. S. P.*

Origin.—A mixture of the enzymes naturally existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog.

Description and Properties.—A yellowish, yellowish-white, or grayish amorphous powder, odorless, or having a faint, peculiar, not unpleasant odor, and a somewhat meat-like taste. Slowly and almost completely soluble in water, insoluble in alcohol.

Pancreatin digests albuminoids and all proteid substances, converts starch into sugar, and, when not over twenty-four hours old, aids in the digestion of fats. Prolonged contact with mineral acids renders it inert.

Dose.—10–20 gr. (0.6–1.2 Gm.).

Antagonists and Incompatibles.—Strong mineral acids.

Synergists.—Weak alkalies.

Physiological Action.—The four ferments which it contains render it capable, in either weak alkaline or acid media, of digesting proteid foods; emulsifying fats and oils, and resolving them into fatty acids and glycerin; converting starch into sugar; and curdling milk.

Therapeutics.—Like pepsin, it is used as an artificial agent in certain disorders of digestion.

Administration.—It may be given dry, in powder, capsules, or compressed pills, or in solution. It should be administered in combination with an alkali, as the activity of pancreatin is destroyed by acids, and should be given ordinarily from two to four hours after meals, when the chyme has entered the intestine. ¶t may also be administered immediately after eating or with the food, since there is an interval of from fifteen minutes to half an hour after the ingestion of food before the stomach-contents are rendered sufficiently acid by the gastric juice to interfere with the activity of the pancreatin.

For rectal nourishment pancreatin is preferable to pepsin, because of its superior action in predigesting food.

Papain, Papoid, or Papayotin.

Origin.—The inspissated juice of the unripe fruit of *Carica Papaya.*

Description and Properties.—A whitish, slightly astringent powder, soluble in water.

Dose.—1–8 gr. (0.06–0.5 Gm.).

Antagonists and Incompatibles.—Tannic and gallic acids. Lead salts and alcohol are incompatible with papain.

Synergists.—The digestive ferments.

Physiological Action.—In this it resembles pepsin, though differing from the latter, as well as from pancreatin, in that it is equally active in neutral, alkaline, or acid media. It converts proteids into soluble peptones, and acts as a stimulant to the gastric glands. It converts starch into maltose, and upon false membranes acts more energetically than pepsin. It may dissolve intestinal worms.

Therapeutics.—*Externally.*—The uses of papain are more manifold than those of the digestive ferments previously mentioned. Like pepsin, it has been successfully employed to dissolve false membrane in *diphtheria* and *croup*. The juice of pineapple, which possesses a ferment (bromelin) similar to that of papain, is a valuable domestic remedy in these diseases. Papain has been used with some benefit in *indurated eczema* and in *syphilitic ulcerations* of the *tongue*. It has been highly recommended by Johnston as a *solvent* of *cerumen:* 15 drops (1.0 Cc.) of a solution of 20 grains to 1 oz. (1.2 Gm–30 Cc.) of distilled water are dropped into the outer meatus, and the parts syringed an hour afterward with a solution of boric acid.

Internally, papain may be used for the same purposes as pepsin and pancreatin; yet, while theoretically superior, it is practically inferior to them, fortunately not having supplanted them in actual practice.

Administration.—When used to aid digestion, papain should be given after meals, either in powders, capsules, compressed tablets, or aqueous solution freshly prepared.

GROUP II.—FATS AND OILS.

Ōleum Mŏrrhuæ—Ōlei Mŏrrhuæ—Cod Liver Oil. *U. S. P.*

Origin.—A fixed oil obtained from the fresh livers of *Gadus Morrhua* L. and other species of *Gadus*.

Description and Properties.—A pale-yellow, thin, oily liquid, having a peculiar, slightly fishy, but not rancid odor, and a bland, slightly fishy taste. Specific gravity 0.920 to 0.925 at 15° C. (59° F.). Scarcely soluble in alcohol, but readily soluble in ether,

chloroform, or carbon disulphide, also in 2.5 parts of acetic ether. It contains several glycerides, the principal one being olein, traces of iodine, bromine, chlorine, biliary salts, phosphoric and sulphuric acids, a peculiar principle (gaduin), and several alkaloids, possibly decomposition-products.

MORRHUOL, a name given by Chapoteaut to a mixture of the various alkaloids and important principles of cod-liver oil, occurs as an amber-brown, bitter, aromatic liquid.

Dose.—1–4 fluidrachms (3.8–15 Cc.).

Physiological Action.—*Externally and Locally.*—It possesses emollient properties, and may be applied to the skin and mucous membranes without causing irritation. It slightly reduces temperature in fever when applied to the body.

Internally.—Fat is a normal and necessary constituent of the body. It is the fuel used to supply energy, and those tissues and organs which are the most active require the most fat. Consequently, nerves, muscles, and glands are more abundantly furnished with fat than cartilage, and in cases of starvation those structures demanding the greater supply must have it, at the expense of the less highly organized and active tissues—as is seen in the great emaciation preceding the decline of mental powers. The blood contains about one-half of 1 per cent. of fat; the muscles, 3 per cent.; the brain, 8 per cent.; and the nerves 22 per cent. In order, therefore, that the various cells of the body may possess sufficient vitality to withstand by physiological resistance the encroachments of disease and the invasion of pathogenic micro-organisms, this equilibrium must be maintained. Yet this necessary food, fat, is more frequently deficient than any other, from the difficulty either of obtaining a supply or of digesting and assimilating it.

Dr. Hughes Bennett was near the truth in observing that "the main causes of tuberculosis are the dearness of butter and the abundance of pastry-cooks," intimating that the poor and underfed are unable to obtain sufficient fat, while the digestion of the wealthy class is deranged by pastries, so that they are unable to assimilate a proper amount of fat.

Dr. Brunton cites the case of a barrister who before pleading a case invariably took a full dose of cod liver oil, believing that it rendered his mind more active.

Before oils or fats can enter the various cells and act as food, and consequently a source of power, they must be digested and assimilated by the system. The value of an oil is based upon—(1)

Its rate of absorption; (2) its rate of oxidation; (3) its agreeable taste.

Cod liver oil, while to many persons repugnant in taste, is more readily absorbed and oxidized than any other fat. It has already been prepared by the liver, and therefore partly elaborated, and, owing to the biliary salts which it contains, it passes more readily through animal membranes. Moreover, Naumann has shown that cod liver oil is more easily oxidized than any other oil, rendering this substance almost an ideal ready-made food. Its actions upon the several systems are here considered.

Digestive System.—Large doses disturb the stomach and may even occasion vomiting, but in medicinal doses alone, or in the form of an emulsion, it may be taken usually without discomfort, in some cases even increasing the appetite. In the stomach cod-liver oil is unaffected, but in the intestines it meets the pancreatic juice, which resolves a portion of it into glycerin and fatty acids, the latter combining with the alkalies of the bile and the intestinal juice to form soaps, while the remaining, and larger, portion is emulsionized by the alkaline secretions of the intestines.

Circulatory System.—The number of red corpuscles is increased and the quality of the blood is greatly improved.

Nervous System.—This shares with the other tissues of the body the general amelioration, the drug being a food and tonic to the brain and nerves.

Respiratory System.—No special action is noticeable other than the natural improvement in the respiratory power incidental to better blood and an increased functional activity of the nerves and muscles.

Absorption and Elimination.—Cod liver oil can be absorbed only after it enters the intestines. The glycerin and fatty acids formed by the pancreatic juice are readily absorbed by the mucous membrane, together with the soaps produced by the action of the bile and the intestinal juice.

The oil remaining, as has been stated, is emulsionized—that is, it is subdivided into minute globules each enclosed in an envelope composed of alkaline albuminate and soap, which has a great affinity for the mucous membrane and carries the oil through the columnar epithelium of the intestinal villi into the lymph-spaces. The osmosis inward of the oil-emulsion is rendered still easier by the action of the bile with which the mucous membrane is bathed.

Oils and fats which are absorbed and not needed for cell-food are deposited beneath the skin as subcutaneous fat, serving as a protection against external cold as well as a reserve supply in case the economy needs more fat than can be taken into the system and assimilated. The weight, therefore, is usually greatly increased under the administration of cod liver oil.

It will be seen that much of the oil taken into the system is oxidized, being subsequently excreted as carbonic acid and water.

Temperature.—When taken internally the temperature is unaffected, but, as has been observed, when applied to the epidermis the bodily heat is reduced.

Untoward Action.—In addition to disturbances of digestion sometimes occasioned by moderate doses, cod liver oil at times produces a vesicular eczema which may spread over the entire body. This eruption is probably caused by the volatile fatty acids which the oil contains. At times it may cause a diarrhea.

Poisoning.—Cod liver oil possesses no poisonous action.

Therapeutics.—*Externally and Locally.*—Cod liver oil is much used by dermatologists in diseases of the skin, being especially serviceable in softening the crusts of *eczema.* It has been applied to the skin to *allay irritation* and for the *reduction of temperature* in the *exanthemata.* In cases of *marasmus* and *rachitis,* and in *wasting diseases* generally, it is a valuable remedy to sustain the vital energy and improve nutrition, the oil being given in the form of baths.

Daily inunctions are beneficial in *chronic scaly skin diseases,* while a local application to the chest has seemed at times to influence favorably the course of *pertussis.*

Internally.—For two or three centuries cod liver oil has been used both externally and internally for *chronic rheumatism,* but it is only since 1841 that it has been employed in the treatment of *tuberculosis.* While to-day it does not receive the enthusiastic support which attended its introduction in the latter disease, it is nevertheless a standard and highly efficacious remedy in the various forms of the disorder. It is equally valuable in *scrofulous affections,* and even more potent in *rachitis. Chronic bronchitis* is perhaps more frequently relieved by its use than by any other internal remedy. Diseases resulting in *anemia* are usually more benefited by cod liver oil than by other remedial agents. *Chronic arthritis, fistula,* and *abscess* in the neighborhood of the joints have been greatly improved by its use. *Atheroma of the arteries* and many

cutaneous diseases, particularly the *strumous* variety, and *syphilodermata* yield to its alterative and nutrient properties.

Probably no single drug is employed in *nervous diseases* with effects so markedly beneficial as those of cod liver oil. While possessing no specific action, it increases the strength and vitality of the patient, enabling him to resist morbid tendencies more successfully, and, by augmenting the force-producing material and improving the condition of the nerves, lessens the liability to nervous derangement.

Diabetes mellitus and *Bright's disease*, with anemia yet unattended by marked digestive disturbance, are decidedly improved by the administration of cod liver oil.

Should no gastric disorder supervene, this remedy should invariably be given in the last-named diseases. It certainly serves to maintain the general health, and is singularly efficacious in prolonging the lives of the afflicted patients, enabling them to profit by hygienic measures, upon which great reliance should be placed. The tonic and nutritive properties of the drug have been strikingly shown in the rapid improvement of patients *convalescing* from *acute diseases*. In *catarrhal conditions*, especially in *ozena* and *otitis* following measles and scarlet fever, it is of marked benefit.

Without entering upon specific considerations other than the above, it will be seen that cod liver oil is indicated whenever there is defective activity, whether inherited or acquired.

Contraindications.—It is to be remembered that cod liver oil is a food and not a medicine: it is therefore contraindicated in all diseases where it proves detrimental to the appetite, causing eructation, heartburn, diarrhea, etc. It is usually contraindicated in fevers, owing to the suspension of the secretions and impairment of digestion characteristic of acute febrile disorders.

Administration.—In the early use of cod liver oil it is advisable to prescribe small doses, that its toleration by the stomach may be gradually acquired. To many patients, however, it is extremely distasteful, and the repugnance is increased rather than lessened by continued use. In such cases it is better, if possible, to disguise the taste and smell in some manner rather than to abandon so valuable a remedy when clearly indicated. Various means have been employed for this purpose. An emulsion may be made which obviates its disagreeable qualities. There are in the market soft capsules containing this oil that serve an excellent purpose, being easily swallowed and disguising completely the

taste and odor of the drug. Administration should occur ordinarily some time after meals, that the oil may reach the intestines as soon as possible.

GROUP III.—MINERAL ACIDS.

MINERAL ACIDS are classed here as Restorative Medicines, because some of them appear in the normal secretion from certain glands, as, for instance, the gastric glands and in the perspiration and urine. Sulphuric and nitric acids are not normal constituents of the body, and are by some authors classed as escharotics, although the action and medical uses of these inorganic acids will here be considered. There are, however, certain characteristics common to all mineral acids which claim primary attention:

1. Concentrated mineral acids are caustic to a greater or less degree.

2. They combine with alkalies and alkaline earths to form salts, and unite with vegetable acids, setting them free from their combination with bases.

3. When in contact with the tissues of the body they combine with the protoplasm, neutralizing the alkalies which the latter contains and forming mineral salts. They also combine with the albumin, forming acid albumin.

4. Upon the blood they precipitate the albuminous constituents and decompose the hemoglobin.

5. Acids are said to *stimulate* the secretion from alkaline glands. On the other hand, they *depress* the secretion from acid glands.

6. They diminish the functional activity of the muscular and nervous systems. Applied locally in a concentrated form, or taken internally in poisonous doses, they tend to produce rigidity of the muscles by coagulating the myosin (Brunton).

7. The alkalinity of the blood is lessened and the acidity of the urine increased by the internal administration of all mineral acids.

Ăcidum Hydrochlōricum—Ăcidi Hydrochlōrici—Hydrochloric Acid. *U. S. P.*

(Muriatic Acid.)

Origin.—A liquid composed of 31.9 per cent. by weight of Absolute Hydrochloric Acid (HCL = 36.37) and 68.1 per cent. of Water.

Description and Properties.—A colorless, fuming liquid, of a pungent odor and an intensely acid taste. Fumes and odor disappear on diluting the acid with 2 volumes of water. Specific gravity about 1.163 at 15° C. (59° F.). Miscible in all proportions with water and alcohol. Hydrochloric acid should be kept in dark, amber-colored, glass-stoppered bottles.

Dose.—2–5 minims (0.12–0.3 Cc.), well diluted.

Official Preparations.

Ăcidum Hydrochlōricum Dilūtum—Ăcidi Hydrochlōrici Dilūti—Diluted Hydrochloric Acid (Diluted Muriatic Acid).—*Dose*, 10–20 minims (0.6–1.2 Cc.). Formula: Hydrochloric Acid, 100; Distilled Water, 219. Sp. gr. about 1.050.

Ăcidum Nitrohydrochlōricum—Ăcidi Nitrohydrochlōrici—Nitrohydrochloric Acid.—*Dose*, 2–5 minims (0.12–0.3 Cc.), well diluted. (Described under *Nitric Acid.*)

Ăcidum Nitrohydrochlōricum Dilūtum—Ăcidi Nitrohydrochlōrici Dilūti—Diluted Nitrohydrochloric Acid.—*Dose*, 5–20 minims (0.3–1.2 Cc.). (Described under *Nitric Acid.*)

Ăcidum Phosphŏricum—Ăcidi Phosphŏrici—Phosphoric Acid. *U. S. P.*

Origin.—A liquid composed of not less than 85 per cent. by weight of Absolute Orthophosphoric Acid ($H_3PO_4 = 97.8$) and not more than 15 per cent. of Water.

Description and Properties.—A colorless liquid, without odor, but having a strongly acid taste. Specific gravity not below 1.710 at 15° C. (59° F.). Miscible in all proportions with water or alcohol. Phosphoric acid should be kept in glass-stoppered bottles.

Dose.—The diluted acid only is given internally.

Official Preparation.

Ăcidum Phosphŏricum Dilūtum—Ăcidi Phosphŏrici Dilūti (Diluted Phosphoric Acid).—*Dose*, 5–25 minims (0.3–1.5 Cc.). Diluted phosphoric acid contains 10 per cent. by weight of absolute orthophosphoric acid.

Ăcidum Sulphūricum—Ăcidi Sulphūrici—Sulphuric Acid. *U. S. P.*

Origin.—A liquid composed of not less than 92.5 per cent. by

weight of Absolute Sulphuric Acid ($H_2SO_4 = 97.82$) and not more than 7.5 per cent. of Water.

Description and Properties.—A colorless liquid of oily consistence, inodorous, and very caustic and corrosive. Specific gravity not below 1.835 at 15° C. (59° F.). Miscible in all proportions with water and alcohol, with evolution of so much heat that the mixing requires great caution. Sulphuric acid should be kept in glass-stoppered bottles.

Dose.—2–5 minims (0.12–0.3 Cc.), well diluted.

Official Preparations.

Ăcidum Sulphūricum Aromăticum—Ăcidi Sulphūrici Aromătici—Aromatic Sulphuric Acid.—*Dose*, 5–20 minims (0.3–1.2 Cc.). Formula: Sulphuric Acid, 100; Tincture of Ginger, 50; Oil of Cinnamon, 1; Alcohol, to make 1000 parts.

Ăcidum Sulphūricum Dilūtum—Ăcidi Sulphūrici Dilūti—Diluted Sulphuric Acid.—*Dose*, 5–20 minims (0.3–1.2 Cc.). Diluted sulphuric acid contains 10 per cent. by weight of absolute sulphuric acid.

Ăcidum Nītricum—Ăcidi Nītrici—Nitric Acid.
U. S. P.

Origin.—A liquid composed of 68 per cent. by weight of Absolute Nitric Acid ($HNO_3 = 62.89$) and 32 per cent. of Water.

Description and Properties.—A colorless, fuming liquid, very caustic and corrosive, and having a peculiar, somewhat suffocating odor. Specific gravity about 1.414 at 15° C. (59° F.). Nitric acid should be kept in dark, amber-colored, glass-stoppered bottles.

Dose.—2–5 minims (0.12–0.3 Cc.), well diluted.

Official Preparations.

Ăcidum Nītricum Dilūtum—Ăcidi Nītrici Dilūti—Diluted Nitric Acid.—*Dose*, 5–20 minims (0.3–1.2 Cc.). Diluted nitric acid contains 10 per cent. by weight of absolute nitric acid.

Ăcidum Nitrohydrochlōricum—Ăcidi Nitrohydrochlōrici—Nitrohydrochloric Acid.—Formula: Nitric Acid, 180; Hydrochloric Acid, 820 parts.

Description and Properties.—A golden yellow, fuming, and very corrosive liquid, having a strong odor of chlorine. Completely volatilized by heat. It readily dissolves gold-leaf, and a drop of it added to potassium iodide T. S. liberates iodine.

Dose.—1–3 minims (0.06–0.18 Cc.).

Ăcidum Nitrohydrochlōricum Dilūtum—Ăcidi Nitrohydrochlōrici Dilūti—Diluted Nitrohydrochloric Acid.—*Dose*, 5–20 minims (0.3–1.2 Cc.). Formula: Nitric Acid, 40; Hydrochloric Acid, 180; Distilled Water, 780 parts.

Antagonists and Incompatibles.—Hydrochloric acid and its preparations are incompatible (forming explosive compounds) with

oxidizable substances—phosphorus, sulphur and the sulphides, alcohols, ethers, carbohydrates, etc. All the mineral acids are incompatible with the alkalies and their carbonates, salts of lime, lead, and silver, and decompose glucosides.

Synergists.—The action of hydrochloric acid upon the digestive system is aided by the digestive ferments and the vegetable bitters.

Physiological Action.—The general action of mineral acids upon the various systems is herewith given in detail:

Externally and Locally.—Applied in a concentrated form to the skin or to any tissue of the body, acids abstract the water from the tissues and destroy the protoplasm, acting as escharotics. Weaker solutions *vesicate*, merely inflaming the parts to which they are applied, without destroying the tissue, while extremely diluted or weak solutions are irritant and *astringent.*

Internally.—Digestive System.—Diluted acids only should be administered internally. Save with reference to the poisonous effects of concentrated acids, therefore, the physiological action of diluted acids only will be here considered.

The salivary glands are stimulated, resulting in an increased flow of saliva, moistening the mouth and allaying thirst. The appetite and digestion are improved, and the secretions from the liver and the duodenal glands are increased. Long-continued use of the mineral acids impairs digestion by lessening the normal secretion of the gastric glands, while protracted use may produce salivation and a train of symptoms—anemia, loss of flesh, etc. Mineral acids tend to constipate the bowels.

Circulatory System.—Diluted acids in medicinal doses cause a rise in blood-pressure, and increased action of the heart, probably due to their stimulating action on the vaso-motor mechanism. Concentrated acids relax the muscular tissue of both the heart and blood-vessels. Mineral acids combine with the albumin or the alkaline bases of the blood, lessening the alkalinity of that fluid.

Nervous System.—Medicinal doses, so far as observed, produce no special action upon the nervous system other than to occasion a slight stimulation of the brain, due probably to a gentle arterial excitement.

Respiratory System.—No important action under medicinal doses has been observed.

Absorption and Elimination.—Mineral acids, above all hydrochloric acid, are readily absorbed. They are quickly converted

into neutral salts in the intestines, and are absorbed as such. The excess of the acid which does not enter into combination in the stomach and intestines is rapidly absorbed into the blood, combining with its alkaline bases, and in this form is excreted, principally by the kidneys, as acid salts.

Temperature.—Medicinal doses have no influence upon temperature.

Untoward Action.—Mineral acids under too prolonged administration impair the appetite and disturb digestion, occasioning toothache and gastric oppression, and at times salivation and diarrhea. They may also produce anemia, paleness of skin, and loss of flesh (Nothnagel and Rossbach). The prolonged use of nitric acid may produce erosion of the gums and tongue, with loosening of the teeth.

Poisoning.—The mineral acids when taken in a concentrated form and in toxic doses act like corrosive poisons, causing intense burning in the stomach and intestines and active gastric inflammation. Violent vomiting occurs, the ejected matter containing blood, and, in the case of hydrochloric acid, a white cloud of ammonium chloride is discerned if the ejecta be placed near the vapor of ammonia.

The respiration is greatly depressed, and there is a strong, persistent acid taste in the mouth, the mucous membrane of which is discolored, while the tongue is swollen and inflamed. There is great thirst, and the pulse becomes rapid and tense. The temperature, at first elevated, soon falls below normal, profound prostration supervening, and death resulting either from shock or from secondary inflammation.

A *post-mortem* examination shows the results of corrosive poisoning: ulceration or evidences of intense inflammation of the mucous membrane of the mouth, esophagus, stomach, and intestines. Occasionally the walls of the latter are perforated. Should death be delayed for some time, there is found fatty degeneration of the kidneys and other internal organs.

Treatment of Poisoning.—This should be prompt. The cautious administration of alkalies is indicated to neutralize the acid, though the evolution of carbonic-acid gas resulting therefrom may rupture the stomach. The stomach should be washed out, and this treatment followed by demulcent drinks and oil, milk, and eggs. Opium may be necessary for the relief of pain, and brandy or whiskey subcutaneously in case of collapse.

Therapeutics.—*Externally and Locally.*—HYDROCHLORIC ACID

is employed as a caustic in *noma* and *putrid sore throat.* Mixed with two or three parts of honey, it is an efficient application to the throat in *diphtheria.* Andrews and Morris have recommended diluted hydrochloric acid for the *removal* of *sequestra*, and Chassaignac has utilized the acid in removing necrosed bone in *osteitis* and *caries.*

NITRIC ACID is a much more powerful caustic, and as such is used more extensively than any other mineral acid, because of its limited action and the ease with which it is controlled. It is an excellent caustic in cases of *cancer of the cervix*, *venereal warts*, *hospital gangrene*, *phagedenic ulceration*, *hemorrhoids*, and *prolapse of the rectum*, especially in the case of children. In cases also of *fungoid granulation* and *excessive hemorrhage from the uterus* it has been highly recommended. In certain *diseases of the throat*, *nose*, and *ear* this acid has been used for the destruction of growths, as well as for its escharotic action in ulcerated conditions.

Dermatologists find nitric acid to be an efficient application for the removal and destruction of *epithelioma*, *moles*, *nevi*, *chloasma*, etc., caution being exercised in the latter case merely to produce an exfoliation of the skin, not sufficient destruction of tissue to result in a cicatrix.

Liveing recommends a very weak solution of nitric acid with tincture of opium in *pruritus.*

PHOSPHORIC ACID, in the strength of 50 grains (3.2) to the ounce (30.0 Cc.) of distilled water, has been suggested by Grossich in the treatment of *scrofulous ulcers*, and an injection of this solution into *tuberculous glands* of the neck is highly recommended by the same authority.

SULPHURIC ACID is perhaps the most persistent, irritating, and destructive caustic known. Its affinity for water, and its consequent extensive action, render it when used alone unfit for caustic purposes. Mixed with powdered charcoal, however, it forms a paste which is an efficient caustic application to *chancres*, *cancers*, etc. Frazer considers the strong sulphuric acid the best caustic in the *bites of rabid animals.* Diluted solution, in the proportion of 6 parts of the strong acid to 4 parts of diluted alcohol, has been recommended for *epistaxis.*

Internally.—HYDROCHLORIC ACID, being a normal constituent of the stomach, is indicated in certain forms of *gastric dyspepsia*, particularly in the atonic variety. In these latter cases there is usually decomposition and fermentation of food, which condition is greatly

relieved by the administration of pepsin or hydrochloric acid after meals, or the same with bitters before meals.

In *intestinal indigestion* hydrochloric acid is an admirable remedy, given one or two hours after meals.

The diluted hydrochloric acid is a valuable internal remedy in the treatment of *diphtheria*, and during the course of *fevers*, particularly *typhoid*. As a routine treatment in the latter disease the author almost invariably gives hydrochloric acid in connection with pepsin, finding that it not only allays thirst and moistens the tongue, but exerts an antiseptic influence in the bowels, thereby lessening the danger of auto-infection and relapse. Alkiewicz recommends weak solutions of hydrochloric acid as efficacious in *nausea* and *vomiting* accompanying certain infectious diseases.

In certain *affections of the skin* dependent upon deranged digestion hydrochloric acid often proves a potent remedy.

NITRIC ACID has been used for the same purposes as hydrochloric acid, although for digestive disorders it is inferior to the latter drug.

In *intermittent* and *periodical fevers*, however, nitric acid is an efficient remedy. In *hepatic disorders* the diluted nitrohydrochloric acid deservedly holds a high place as a remedial agent, and the same remedy is frequently employed with success in *chronic syphilis*.

In the conditions known as *oxaluria* and *lithæmia* nitric and nitrohydrochloric acids serve an excellent purpose.

The invaluable preparation introduced by Dr. Hope in 1826, known as "Hope's camphor mixture"—a combination of nitrous acid, camphor-water, and tincture of opium is of very great service as a remedy in *serous diarrhea*.

The *aphonia* of singers and public speakers is often relieved by the diluted nitric acid, certain cases of *bronchitis* being also benefited by the same remedy.

Melancholia and the *hypochondriasis* of dipsomaniacs are sometimes relieved by diluted nitrohydrochloric acid.

PHOSPHORIC ACID has acquired some reputation as a remedy in *anemia* and as a tonic in *wasting diseases* and *neurasthenia*. Its value, however, is based more upon theory than upon the results of clinical observation. The experience of the author warrants the assumption that phosphoric is inferior to hydrochloric acid in these conditions, its action being entirely due to increasing digestion and thereby improving nutrition.

Probably phosphoric acid is superior to the other mineral acids

only in its action in *diabetes*, in which disease it certainly possesses a remarkable influence in diminishing thirst and lessening the secretion of urine.

SULPHURIC ACID, in the author's opinion, is inferior to nitric or nitrous acid in *serous diarrhea*. It is nevertheless an invaluable, as well as an old and tried, remedy in *cholera*, the statistics furnished by the Insane Department of the Philadelphia Almshouse during an epidemic of this disease appearing to prove its efficacy.

This remedy also deserves favorable consideration in the treatment of *acute lead-poisoning*. Moreover, in *chronic lead-poisoning* water acidulated with sulphuric acid makes an efficient prophylactic, and the remedy has also been suggested as a preventive of *Asiatic cholera*.

Owing to its astringent and antiseptic properties this acid, particularly the aromatic sulphuric acid, proves a good remedy in certain cases of diarrhea. It is especially valuable in limiting the *sweating in phthisis*. The same preparation has been found beneficial in *hematemesis*, as well as in *intestinal* and *uterine hemorrhage*.

Where there is a tendency to dissolution of the blood, as in *scurvy* and *purpura*, sulphuric acid has proved valuable, and it has been recommended as an internal remedy in *lichen*, *prurigo*, and many *itching diseases of the skin*.

Contraindications.—Acute inflammation of the stomach, rheumatism, gout, and where the urine is excessively acid and of high specific gravity.

Administration.—Only the diluted acids should be given internally, and even these should be further diluted, and taken, if possible, through a glass tube, to prevent injury to the enamel of the teeth. They are best given after meals, and should not be administered for too long a period; and the first indication of untoward action, such as griping, diarrhea, etc., is to be taken as a warning that the drug must be withdrawn.

Ăcidum Lăcticum—Ăcidi Lăctici—Lactic Acid.

U. S. P.

Origin.—An organic acid usually obtained by subjecting milk sugar or grape sugar to lactic fermentation. It is composed of 75 per cent. by weight of Absolute Lactic Acid ($CHC_3H_5O_3 = 89.79$) and 25 per cent. of Water.

Description and Properties.—A colorless, syrupy liquid, odorless, of a purely acid taste, and absorbing moisture on ex-

posure to damp air. Specific gravity about 1.213 at 15° C. (59° F.). Freely miscible with water, alcohol, or ether; insoluble in chloroform, benzin, or carbon disulphide.

Dose.—20–30 minims (1.2–1.8 Cc.), diluted and sweetened.

Official Preparation.

Sȳrupus Călcii Lactophosphătis—Sȳrupi Călcii Lactophosphătis—Syrup of Calcium Lactophosphate.—*Dose*, 1–2 fluidrachms (3.7–7.3 C.). Formula: Precipitated Calcium Carbonate, 25; Lactic Acid, 60; Phosphoric Acid, 36; Orange Flower Water, 25; Sugar, 700; Water, q. s. ad 1000.

Antagonists and Incompatibles.—Alkalies and the salts of the mineral acids are incompatible with lactic acid.

Synergists.—Pepsin, vegetable acids, hydrochloric acid, and sodium chloride.

Physiological Action.—*Externally and Locally.*—Lactic Acid is a caustic to highly organized tissues, resembling the mineral acids in its local action. It dissolves false membrane to which it is applied.

Internally.—Digestive System.—It is thought to be present in the stomach during the first forty-five minutes of stomachic digestion, but cannot be considered a normal constituent of the gastric juice.

Circulatory System.—Being absorbed from the stomach, it combines with bases in the blood, forming lactates which are rapidly converted into carbonates. In certain morbid conditions of the system, such as acute rheumatism, it is found free in the blood.

Richardson has produced endocarditis in dogs by injecting lactic acid into the peritoneal cavity. Large doses decrease the normal alkalinity of the blood.

Nervous System.—Large doses greatly depress the nervous system, frequently producing neuralgia and myalgia.

Absorption and Elimination.—It is absorbed from the stomach, undergoes a change in the blood, and is eliminated by the kidneys, although, according to Lehmann, when large doses have been taken it is found in the urine unchanged; and we have Benzelius and Scherer as authorities that lactic acid can be detected in the spleen and the muscular fluid and has been found in the exudates of puerperal fever.

Untoward Action, Poisoning, and Treatment of Poisoning are similar to those of the mineral acids.

Therapeutics.—*Externally and Locally.*—It has been used

locally for the same purposes as the mineral acids, but it is thought by many clinicans to be superior to the latter in *tuberculous ulceration*. In the Hamburg General Hospital, Dr. Zippel has employed it with excellent success in the treatment of tuberculous fistulæ. He inserted into the fistula rods made of lactic acid, gelatin, and menthol, enveloped with a thin layer of collodion.

As a solvent of false membranes lactic acid is unquestionably superior to the mineral acids, being highly recommended for this purpose in diphtheria and croup by such authorities as Morell Mackenzie, Lennox Browne, Weber, Dureau, etc.

Internally.—Digestive System.—It is used in the digestive disorders, such as *atonic* and *irritative dyspepsia*, and in all those derangements of digestion which are benefited by hydrochloric acid. In *oxaluria, lithemia, chronic cystitis* with ammoniacal urine, *chronic dysentery*, and *dyspeptic* and *tuberculous diarrhea* it has proved an efficient remedy. It has been recommended by Dr. Foucaut as a prophylactic in *gout*.

Since this drug was suggested by Cantani as a remedy in *diabetes mellitus* it has been used with varying success. Balfour and Foster, as well as Cantani himself, have reported many cases which have greatly improved under the administraton of lactic acid accompanied by an appropriate dietetic regimen. In the continued use of this drug for diabetes, however, it is well to remember that acute rheumatism and rheumatic endocarditis may be induced, endangering the life of the patient even more than the disease for which the drug was prescribed.

Lactic acid has been recommended by Preyer, Mendel, and Maragliano as a hypnotic. Yet the authority appears to rest rather upon theoretical deduction than the result of clinical observation.

Contraindications.—The same as for mineral acids.

Administration.—Lactic acid should be given well diluted.

GROUP IV.—VEGETABLE ACIDS.

Ăcidum Acētĭcum—Ăcidi Acētici—Acetic Acid. *U. S. P.*

Origin.—A liquid composed of 36 per cent. by weight of Absolute Acetic Acid ($HC_2H_3O_2 = 59.86$) and 64 per cent. of Water.

Description and Properties.—A clear, colorless liquid, having

a strong, vinegar-like odor, a purely acid taste, and a strongly acid reaction. Miscible with water or alcohol in all proportions.

Dose.—The diluted acid only is given internally.

Official Preparation.

Ăcidum Acĕticum Dilūtum—Ăcidi Acĕtici Dilūti—Diluted Acetic Acid.—*Dose*, 1-2 fluidrachms (3.7-7.4 Cc.).

Ăcidum Cĭtricum—Ăcidi Cĭtrici—Citric Acid. *U. S. P.*

Origin.—An organic acid usually prepared from lemon-juice.

Description and Properties.—Colorless, translucent, right-rhombic prisms; odorless, having an agreeable, purely acid taste; efflorescent in warm air and deliquescent when exposed to moist air. Soluble in 0.63 part Water, in 1.61 parts of alcohol, in about 0.4 part of boiling water, and in 1.43 parts of boiling alcohol.

Dose.—5–20 grains (0.3–1.25 Gm.).

Official Preparation.

Sȳrupus Ăcidi Cĭtrici—Sȳrupi Ăcidi Cĭtrici—Syrup of Citric Acid.—*Dose*, 2–8 fluidrachms (7.4–30. Cc.) (10 per cent.).

Ăcidum Tartăricum—Ăcidi Tartărici—Tartaric Acid. *U. S. P.*

Origin.—An organic acid usually prepared from argols.

Description and Properties.—Colorless, translucent, monoclinic prisms, or crystalline crusts, or a white powder; odorless, having a purely acid taste, and permanent in air. Soluble in about 0.8 part of water and in 2.5 parts of alcohol; also in about 0.5 part of boiling water and in 0.2 part of boiling alcohol.

Dose.—10–30 grains (0.6–2.0 Gm.).

Antagonists and Incompatibles.—Alkalies are chemically incompatible with the vegetable acids. With the alkaline, earthy, and metallic bases vegetable acids unite to form salts, the acetates of which are all soluble.

Synergists.—Alkalies, and, under certain circumstances, mineral acids and the digestive ferments.

Physiological Action.—*Externally and Locally.*—The vegetable acids have about the same action externally and locally as the diluted mineral acids, not caustic but irritant, acetic acid being the most powerful and citric acid the weakest.

Internally.—Digestive System.—Their action on the salivary and gastric glands is similar to that of the mineral acids. Their influence upon the stomach is not so marked as that of hydrochloric acid, though the secretions from the intestinal glands are more augmented by vegetable than by mineral acids. Too large or prolonged doses of the vegetable acids produce flatulence and abdominal pain, and may even occasion diarrhea or enteritis.

Circulatory System.—Large doses retard and weaken the pulse. As with mineral acids, their tendency is to lessen the alkalinity of the blood. They unite with alkalies in the stomach to form salts, and as such enter the blood, where they are oxidized, the product being carbonic acid, which lessens the alkalinity of the blood and increases the acidity of the urine.

Absorption and Elimination.—As stated, vegetable acids unite with the alkalies to form salts, as such entering the circulation. They are eliminated chiefly by the kidneys, increasing the excretion of both water and solids. Elimination also takes place to a considerable extent by the intestinal canal.

Untoward Action.—Under prolonged dosage there is great emaciation, deterioration of the blood, and a scorbutic condition.

Poisoning.—Their toxic effects are almost identical with those of the mineral acids, the *Treatment of Poisoning* being the same as with the latter.

Therapeutics.—*Externally and Locally.*—All the above-named vegetable acids are irritant, more or less antiseptic, and hemostatic, ACETIC ACID being the most powerful antiseptic of the three. Englemann regards acetic acid as superior to mercuric chloride as a disinfectant in *obstetrical practice*, employing a solution of from 3 to 5 per cent. for this purpose. A diluted solution is a valuable injection in *gonorrhea* of the female. The glacial acetic acid is a powerful caustic, and is much used to dissolve *horny growths*, *warts*, *corns*, etc.

The most important use of acetic acid is in the treatment of certain *parasitic skin diseases*, probably no remedy excelling it in cases of *ringworm* and *pityriasis*. Diluted acetic acid, or vinegar, is an efficient gargle in simple *sore throat* and the last stage of *anginæ* of *exanthemata*, as well as a valuable hemostatic, especially in *epistaxis*.

CITRIC ACID is but little used locally, although solutions have been employed with some success to relieve the itching and stinging of "prickly heat" and *urticaria*. A sponge-bath of vinegar

and water is a grateful and efficient means of *reducing temperature* and checking *excessive sweating* in disease.

TARTARIC ACID has been used by Potter as an application to the throat in *diphtheria*, the effect being to convert the membrane into a gelatinous mass which is more easily expelled.

Internally.—ACETIC ACID is little used internally. Citric acid, however, in the form of a lemonade, is a refreshing refrigerant drink in *fevers*, while a similar hot lemonade taken at bedtime is a valuable and agreeable means of aborting a "cold." Lemon- or lime-juice is an infallible prophylactic against *scurvy*, being unquestionably the most efficient remedy for the disease.

It is well known by the laity that eating lemons increases the functional activity of the liver. Lemons and CITRIC ACID, therefore, are efficient remedies in relieving attacks of *biliousness* and *catarrhal jaundice*, and they even appear to counteract the effects of *malaria*. Lemon-juice is an old and esteemed remedy in *acute rheumatism*.

Vegetable acids are used for the same disorders of the digestive tract as mineral acids, although not so efficient as the latter, especially the hydrochloric. Much of the benefit derived from sour table-wines is due to the fruit-acids they contain.

Contraindications.—Ordinarily the same as for mineral acids. It is a matter of observation that nursing mothers may produce a troublesome diarrhea in the infant by partaking too freely of vinegar or acid fruits.

Administration.—A solution of citric acid may be made of about the acidity of lemon-juice by dissolving 570 grains (36.93 Gm.) in 1 pint (473.17 Cc.) of distilled water. Vegetable acids when taken internally should be mixed with, or dissolved in, water and diluted and sweetened, that they may be pleasant to the taste and acceptable to the stomach.

GROUP V.—ALKALIES.

Alkalies are classed as *Restoratives* because the blood and many secretions of the body are normally alkaline in reaction. The following drugs are numbered among alkalies or antacids: Liquor potassæ, potassii acetas, potassii bicarbonas, potassii bitartras, potassii carbonas, potassii citras, potassii tartras, liquor sodæ, sodii

acetas, sodii bicarbonas, sodii carbonas, sodii carbonas exsiccatus, calcii carbonas præcipitatus, creta preparata, liquor calcis, mistura cretæ, syrupus calcis, lithii benzoas, lithii carbonas, lithii citras, lithii citras effervescens, lithii salicylas, magnesii carbonas, ammonii carbonas, spiritus ammoniæ aromaticus.

Līquor Potăssæ—Liquōris Potăssæ—Solution of Potash. *U. S. P.*

Origin.—An aqueous solution of Potassium Hydrate containing about 5 per cent. of the Hydrate.

Description and Properties.—A clear, colorless liquid, odorless, having a very acrid and caustic taste and a strongly alkaline reaction. It should conform to the same reaction and tests as an aqueous solution of potassa. (See *Potassa.*)

Dose.—5–20 minims (0.3–1.2 Cc.), well diluted.

Potăssii Acētas—Potăssii Acetātis—Potassium Acetate. *U. S. P.*

Origin.—Prepared by the action of Acetic Acid upon Potassium Carbonate.

Description and Properties.—A white powder or crystalline masses, of a satiny lustre, odorless, and having a warm, saline taste; very deliquescent on exposure to the air. Soluble in 0.36 part of water and in 1.9 parts of alcohol; with increasing temperature it becomes much more soluble in both liquids. Potassium acetate should be kept in well-stoppered bottles.

Dose.—15–60 grains (1.0–4.0 Gm.).

Potăssii Bicarbōnas—Potăssii Bicarbonātis—Potassium Bicarbonate. *U. S. P.*

Origin.—Prepared by the action of Carbon Dioxide upon a solution of the Carbonate.

Description and Properties.—Colorless, transparent, monoclinic prisms, odorless, and having a saline and slightly alkaline taste. Permanent in the air, soluble in 3.2 parts of water at 15° C. (59° F.) and in 1.9 parts at 50° C. (122° F.). At a higher temperature the solution rapidly loses carbon dioxide, and, after boiling, contains only potassium carbonate. It is almost insoluble in alcohol. The drug should be kept in well-stoppered bottles.

Dose.—10–40 grains (0.6–2.5 Gm.).

Potassii Bitartras—Potassii Bitartrātis—Potassium Bitartrate. *U. S. P.*

(Cream of Tartar.)

Origin.—Prepared by purifying and crystallizing Argol or Crude Tartar, a residuum of grape-juice after fermentation.

Description and Properties.—Colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, odorless, and having a pleasant, acidulous taste; permanent in the air. Soluble in about 200 parts of water and in about 16.7 parts of boiling water; very slightly soluble in alcohol.

Dose.—10 grains–½ ounce (0.6–16.0 Gm.).

Official Preparation.

Pulvis Jalapæ Compositus—Pulveris Jalapæ Compositi—Compound Powder of Jalap.—*Dose*, 10–30 grains (0.6–2.0 Gm.); used as a hydragogue cathartic.

Potassii Carbonas—Potassii Carbonātis—Potassium Carbonate. *U. S. P.*

Origin.—Prepared from the ash obtained from the residue of the beet-sugar manufacture. It may also be obtained from wood-ashes.

Description and Properties.—A white, granular powder, odorless, and having a strongly alkaline taste; very deliquescent; soluble in 1.1 parts of water at 15° C. (59° F.) and in about 0.65 part of boiling water; insoluble in alcohol. Its aqueous solution (1 in 20) has a strongly alkaline reaction upon litmus-paper, and effervesces with acids. Potassium carbonate should be kept in well-stoppered bottles.

Dose.—5–30 grains (0.3–2.01 Gm.).

Potassii Citras—Potassii Citrātis—Potassium Citrate. *U. S. P.*

Origin.—Prepared by the action of Citric Acid upon a solution of Potassium Carbonate.

Description and Properties.—Transparent, prismatic crystals, or a white, granular powder, odorless, and having a cooling, saline taste; deliquescent on exposure to the air. Soluble in 0.6 part of water at 15° C. (59° F.), and very soluble in boiling water; feebly soluble in alcohol. Potassium citrate should be kept in well-stoppered bottles.

Dose.—15–60 grains (1.0–4.0 Gm.).

Potassii Tartras—Potassii Tartrātis—Potassium Tartrate. (Unofficial.)

Origin.—Prepared by the action of Acid Potassium Tartrate upon Potassium Carbonate.

Description and Properties.—It occurs usually in the form of a granular or fine white powder, inodorous, and of a saline, bitterish taste. Soluble in 0.75 part of water at 2° C. (35.6° F.), and in 0.47 part of water at 64° C. (147.2° F.).

Dose.—30 grains–½ ounce (2.0–16.0 Gm.).

PREPARATIONS OF SODIUM.

Līquor Sōdæ—Liquōris Sōdæ—Solution of Soda. *U. S. P.*

(Solution of Sodium Hydrate.)

Origin.—An aqueous solution of Sodium Hydrate (NAOH = 39.96), containing about 5 per cent. of the Hydrate.

Description and Properties.—A clear, colorless liquid, odorless, having a very acrid and caustic taste and a strongly alkaline reaction.

Dose.—5–20 minims (0.3–1.8 Cc.).

Sōdii Acētas—Sōdii Acetātis—Sodium Acetate. *U. S. P.*

Origin.—It may be obtained by neutralizing Acetic Acid with Sodium Carbonate. The usual article, however, is manufactured on a large scale in the United States in the process of purifying acetic acid from wood vinegar.

Description and Properties.—Colorless, transparent, monoclinic prisms, or a granular, crystalline powder, odorless, and having a cooling, saline taste; efflorescent in warm, dry air. Soluble in 1.4 parts of water and in 30 parts of alcohol; also in 0.5 part of boiling water and in 2 parts of boiling alcohol. Sodium acetate should be kept in well-stoppered bottles.

Dose.—15–60 grains (1.0–4.0 Gm.).

Sōdii Bicarbōnas—Sōdii Bicarbonātis—Sodium Bicarbonate. *U. S. P.*

Origin.—Prepared by saturating a mixture of 2 parts of Crystallized and 3 parts of Dried Sodium Carbonate with Carbon Diox-

ide, generated by the action of hydrochloric acid upon marble. The damp Salt formed is shaken with half its weight of Distilled Water, the undissolved portion being dried by exposure to the air.

Description and Properties.—A white, opaque powder, odorless, and having a cooling, mildly alkaline taste; permanent in dry, but slowly decomposed in moist, air. Soluble in 11.3 parts of water at 15° C. (59° F.); above that temperature the solution loses carbon dioxide, and at a boiling heat the salt is entirely converted into normal carbonate. Insoluble in alcohol and ether. The drug should be kept in well-closed vessels, in a cool place.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Mistūra Rhēi et Sōdæ—Mistūræ Rhēi et Sōdæ—Mixture of Rhubarb and Soda.—*Dose*, ½–2 fluidounces (7.4–59 Cc.).

Trochīsci Sōdii Bicarbonātis—Trochīscos (acc.) **Sōdii Bicarbonātis—Troches of Sodium Bicarbonate.**—*Dose*, 1 to 6 troches.

Sōdii Carbōnas—Sōdii Carbonātis—Sodium Carbonate. *U. S. P.*

Origin.—Obtained from Sodium Sulphate and Sodium Chloride, but chiefly by a complicated process, known as *Leblanc's*, from Sodium Sulphate, which is mixed with Chalk and Coal, the mixture ignited, and the resultant mass exhausted with Water and concentrated, the carbonate separating from the hot liquid being purified.

Description and Properties.—Colorless, monoclinic crystals, having a strongly alkaline taste. In dry air the salt effloresces, and if left exposed soon loses about half its water of crystallization (31.46 per cent. of its weight), becoming a white powder. Soluble in 1.6 parts of water at 15° C. (59° F.), in 0.09 part at 38° C. (100.4° F.), in 0.2 part of boiling water, and in 1.02 parts of glycerin; insoluble in alcohol and ether. The aqueous solution gives an alkaline reaction with litmus-paper, and effervesces strongly with acids. The drug should be kept in well-closed vessels.

Dose.—10–30 grains (.06–2.0 Gm.).

Official Preparation.

Sōdii Carbōnas Exsiccātus—Sōdii Carbonātis Exsiccāti—Dried Sodium Carbonate.—*Description and Properties.*—A loose white powder, conforming to the reactions and tests for *sodii carbonas*.

Dose.—3–10 grains (0.2–0.6 Gm.).

PREPARATIONS OF CALCIUM.

Călcii Carbōnas Præcipitātus—Călcii Carbonātis Præcipitāti—Precipitated Calcium Carbonate. *U. S. P.*

Origin.—Prepared by mixing aqueous solutions of Calcium Chloride and Sodium Carbonate, the resulting precipitate of Calcium Carbonate being purified.

Description and Properties.—A fine white powder, without odor or taste, permanent in the air. Nearly insoluble in water, its solubility being increased by the presence of ammonium salts, and especially by carbonic acid, and diminished by alkali hydrates. Insoluble in alcohol, but in diluted acetic, hydrochloric, or nitric acid completely soluble, with effervescence.

Dose.—15–30 grains (1.0–2.0 Gm.).

Crēta Præparāta—Crētæ Præparātæ—Prepared Chalk. *U. S. P.*

Origin.—Native, friable Calcium Carbonate freed from most impurities by elutriation.

Description and Properties.—A white, amorphous powder, often moulded into conical drops, odorless and tasteless, permanent in the air. Almost insoluble in water; insoluble in alcohol; soluble in diluted acetic, hydrochloric, or nitric acid, with copious effervescence, but without leaving more than a trifling residue.

Dose.—5–60 grains (0.3–4.0 Gm.).

Official Preparations.

Hydrărgyrum cum Crētâ—Hydrărgyri cum Cretâ—Mercury with Chalk.—*Dose*, 2–10 grains (0.12–0.6 Gm.). (Described under *Hydrargyrum*.)

Pŭlvis Crētæ Compŏsitus—Pŭlveris Crētæ Compŏsiti—Compound Chalk Powder.—*Dose*, 20–60 grains (1.30–4.0 Gm.).

Trochĭsci Crētæ—Trochĭscos (acc.) **Crētæ—Troches of Chalk.**—*Dose, ad libitum.*

Unofficial Preparations.

Pŭlvis Crētæ Aromăticus—Pŭlveris Crētæ Aromătici—Aromatic Powder of Chalk.—*Dose*, 30–60 grains (2.0–4.0 Gm.). A mixture of Aromatics with Chalk.

Pŭlvis Crētæ Aromăticus cum Ŏpio—Pŭlveris Crētæ Aromătici cum Ŏpio—Aromatic Powder of Chalk and Opium.—*Dose*, 10–20 grains (0.6–1.30 Gm.). 1 grain (.06 Gm.) of Opium in every 40 grains (2.5 Gm.) of the previous mixture.

Līquor Călcis—Liquōris Călcis—Solution of Lime. *U. S. P.*

(Solution of Calcium Hydrate; Lime Water.)

Origin.—A saturated, aqueous solution of Calcium Hydrate.

Description and Properties.—A clear, colorless liquid, without odor, and having a saline and feebly caustic taste. It absorbs carbon dioxide from the air, so that a pellicle of calcium carbonate forms on the surface of the liquid. On being heated it becomes turbid through separation of calcium hydrate, which redissolves when the liquid is cooled. It gives a strong alkaline reaction with litmus paper.

Dose.—½–4 ounces (15.0–118.3 Cc.).

Official Preparations.

Liniměntum Călcis—Liniměnti Călcis—Lime Liniment (Carron Oil).—For external use.

Mistūra Crētæ—Mistūræ Crētæ—Chalk Mixture.—*Dose*, 1–4 fluidrachms (4.0–15. Cc.). Compound Chalk Powder, Cinnamon Water, and Water.

Sўrupus Călcis—Sўrupi Călcis—Syrup of Lime.—*Dose*, ½–2 fluidrachms (1.8–7.4 Cc.).

PREPARATIONS OF LITHIUM.

Lĭthii Carbōnas—Lĭthii Carbonātis—Lithium Carbonate. *U. S. P.*

Origin.—Lithium is found in many mineral waters, the carbonate being prepared from lepidolite.

Description and Properties.—A light white powder, odorless, and having an alkaline taste; permanent in the air. Soluble in 80 parts of water and 140 parts of boiling water; much more soluble in water saturated with carbon dioxide; insoluble in alcohol, but soluble in diluted acids, with active effervescence.

Dose.—2–10 grains (0.12–0.6 Gm.).

Lĭthii Cĭtras—Lĭthii Citrātis—Lithium Citrate. *U. S. P.*

Origin.—Prepared by adding Lithium Carbonate to a solution of Citric Acid.

Description and Properties.—A white powder, odorless, and having a cooling, faintly alkaline taste; deliquescent on exposure to the air. Soluble in 2 parts of water and in 0.5 part of boiling

water; almost insoluble in alcohol or ether. Lithium citrate should be kept in well-stoppered bottles.

Dose.—2–10 grains (0.12–0.6 Gm.).

Official Preparation.

Lĭthii Cĭtras Effervĕscens—Lĭthii Citrātis Effervescĕntis—Effervescent Lithium Citrate.—*Dose*, 1–2 drachms (4.0–8.0 Gm.).

PREPARATIONS OF MAGNESIUM.

Magnēsia—Magnēsiæ—Magnesia. *U. S. P.*

(Light Magnesia; Calcined Magnesia.)

Origin.—Prepared by subjecting Magnesium Carbonate to a low red heat in a Cornish or Hessian crucible closed loosely by a lid.

Description and Properties.—A white, very light, and very fine powder, without odor, and having an earthy, but not a saline, taste. On exposure to the air it slowly absorbs moisture and carbon dioxide. Almost insoluble in water and insoluble in alcohol, but soluble in diluted acids. Magnesia should be kept in well-closed vessels.

Dose.—As an antacid, 10–15 grains (0.6–1.0 Gm.).

Official Preparation.

Pŭlvis Rhēi Compŏsitus—Pŭlveris Rhēi Compŏsiti—Compound Powder of Rhubarb.—*Dose*, as a laxative, 20–60 grains (1.30–4.0 Gm.). Formula: Rhubarb, 25; Magnesia, 65; Ginger, 10 parts.

Magnēsii Carbōnas—Magnēsii Carbonātis—Magnesium Carbonate. *U. S. P.*

Origin.—Prepared by evaporating to dryness the mixed solutions of Magnesium Sulphate and Sodium Carbonate, and purifying and drying the residue.

Description and Properties.—Light, white, friable masses, or a light, white powder, without odor, and having a slightly earthy taste; permanent in the air. Almost insoluble in water, to which, however, it imparts a slightly alkaline reaction; insoluble in alcohol, but soluble in diluted acids, with active effervescence.

Dose.—As an antacid, 5–20 grains (0.3–1.3 Gm.).

PREPARATIONS OF AMMONIUM.

Ammōnii Carbōnas—Ammōnii Carbonātis—Ammonium Carbonate. *U. S. P.*

Origin.—Prepared by a complicated process by heating in an iron or earthen retort a mixture of Sal Ammoniac and Chalk.

Description and Properties.—White, hard, translucent, striated masses, having a strongly ammoniacal odor without empyreuma, and a sharp, saline taste. On exposure to the air the salt loses both ammonia and carbonic acid, becoming opaque, and is finally converted into friable porous lumps or a white powder. Slowly but completely soluble in about 5 parts of water at 15° C. (59° F.), and decomposed by hot water, with the evolution of carbonic acid and ammonia. By prolonged boiling with water the salt is completely dissipated. The aqueous solution possesses a strongly alkaline reaction and effervesces with acids.

Dose.—3–10 grains (0.18–0.6 Gm.).

Official Preparation.

Spīritus Ammōniæ Aromăticus—Spīritus Ammōniæ Aromătici—Aromatic Spirit of Ammonia.—Composition: Ammonium Carbonate, Ammonia Water, Aromatic Oils, Alcohol, and Water.

Description and Properties.—A nearly colorless liquid when freshly prepared, but gradually acquiring a somewhat darker tint. It has a pungent, ammoniacal odor and taste.

Dose.—½–1 fluidrachm (1.8–3.7 Cc.).

Antagonists and Incompatibles.—The alkalies and their carbonates are incompatible with acids and with metallic salts. The ammonium carbonate is incompatible with the acidulous salts and with lime water.

Synergists.—Agents promoting waste, such as vegetable acids, mercury, iodine, etc., increase the therapeutic activity of the alkalies.

Physiological Action.—The alkalies mentioned in this group may be divided into *direct antacids*, or those which neutralize or lessen the acidity of the stomach, and *indirect antacids*, or those which, being oxidized in the blood, are excreted as carbonates, diminishing the acidity of the urine and increasing the alkalinity of the blood, although not influencing the acidity in the stomach.

The *direct antacids* are lime water, prepared chalk, and magnesia.

The *indirect antacids* are potassium acetate, bitartrate, citrate, and tartrate, sodium acetate, and lithium citrate.

The following alkalies are both *direct* and *indirect antacids:* solution of potassa, solution of soda, carbonates and bicarbonates of potassium, sodium, lithium, magnesium, and ammonium.

The physiological action of the various alkalies will now be considered in detail.

Externally and Locally.—The hydrates of potassium and sodium are caustic and rubefacient. The solutions of soda and potassa, when applied undiluted, irritate the surface of the skin and soften and dissolve the epidermis and horny tissues, uniting with the albumin of the various structures to form a soluble alkali-albuminate. The carbonates and bicarbonates exert a similar, though much weaker, action, while the acetates, bitartrates, citrates, and tartrates have no local influence.

The ammonium salts do not affect the epidermis in the manner of those previously mentioned, penetrating without dissolving it, irritating the underlying structures, and inducing an effusion of lymph, thus acting as vesicants. Should a strong solution of ammonia be applied to the skin and evaporation be prevented, suppuration and sloughing may ensue.

Internally.—Digestive System.—Potassium salts in small doses promote the secretion of gastric juice, thus obeying the law by which alkalies augment acid secretions. Large doses neutralize free acid in the stomach, and, by rendering the chyme neutral or alkaline, interfere with the secretion from the pancreas, liver, and intestines, thereby deranging digestion.

Circulatory System.—The salts of potassium, by lessening the acidity of the gastric juice and entering the circulation, increase the alkalinity of the blood. The *bicarbonates*, however, taken in large doses upon an *empty* stomach, enter the circulation unchanged, where, by decomposing the neutral phosphate of sodium present, they form the acid phosphate of sodium, reducing the alkalinity of the blood and increasing the acidity of the urine.

Far different are the effects of these alkalies when taken after meals, the salts being then decomposed in the stomach by the acid gastric juice, the alkaline base increasing the alkalinity of the blood.

The acetates, citrates, and bitartrates enter the blood unchanged. The acid radical being destroyed, and the base combining with the carbon dioxide formed, the salts are converted into the alkaline carbonates, increasing the alkalinity of the blood and urine. It is believed that the amount of hemoglobin is increased by the potassium salts when the blood is deficient in this substance, though large doses interfere with the ozonizing function of the red blood-corpuscles.

Should the caustic alkalies be injected directly into the blood, death quickly ensues from coagulation of that fluid, arising from

excessive formation of alkali-albuminate. Under very large or poisonous doses the heart-muscle is weakened, decreasing the force of its contractions, arrest taking place in diastole. Even medicinal doses, if long continued, may occasion cardiac depression, diminishing the force of the circulation. Small doses may increase blood-pressure, though the pulse-rate be diminished. Brunton and Cash have demonstrated that minute amounts of potassium salts applied to muscle increase its contractile power, while large doses diminish or paralyze this force.

Nervous System.—When potassium salts are administered in medicinal doses and for a reasonable length of time, no important action upon the nervous system is produced; but if excessive doses be taken, the nerve-centers and motor nerves are paralyzed, after a period of temporary excitement. Owing, however, to the fact that potassium is a protoplasmic poison, affecting alike the muscles and nerve-tissues, its salts should not be given in full doses for too long a period without counteracting their depressing influence by the use of muscle- and nerve-tonics.

Respiratory System.—The only action of importance upon the respiratory system is the increased amount and diminished viscidity of the secretion from the bronchial tubes.

Absorption and Elimination.—The potassium salts possess very high diffusive power. They are easily and quickly absorbed and rapidly excreted, the salts with vegetable acids being eliminated as alkaline carbonates, rendering the urine alkaline. Salts of potassium are chiefly eliminated by the kidneys, though the process takes place to some extent through the bronchial mucous membrane and other secretions. They are active diuretics, increasing the amount of water and, by stimulating the renal epithelium, augmenting the excretion of solids. The uric acid is greatly diminished, being converted into urea, and as such eliminated, showing that the alkalies increase oxidation and promote waste.

Temperature.—Medicinal doses have no effect upon temperature.

Untoward Action.—Under prolonged dosage the digestion becomes impaired. There is present paralysis of the muscular fibers of the intestines, accompanied by diarrhea or constipation and tympanites. There may be also present emaciation, muscular weakness, nervous prostration, and anemia.

Poisoning.—The caustic preparations of potassium produce all the symptoms of a corrosive mineral poison, somewhat resembling the poisonous action of the mineral acids already described. Death

is occasionally preceded by convulsions, the heart's action being arrested before respiratory failure. The carbonates and bicarbonates and the salts of vegetable acids are not considered poisonous, nor do they produce the corrosive effects of caustic potash or its solution.

Treatment of Poisoning.—Vegetable acids are chemically incompatible, and should be given freely, together with oils and demulcent drinks as protectives, and opium, if necessary, to relieve pain. Cardiac stimulants—digitalis, brandy, caffeine, etc.—may be required to sustain the heart, to be given hypodermically.

The Comparative Action of the Alkalies.—SODIUM SALTS in their action are analogous to potassium, although less irritating to the gastro-intestinal tract. They are also less depressing to the circulatory, muscular, and nervous systems. They differ from the potassium salts in that they lengthen, instead of shortening, the muscular curve. They are neither absorbed nor eliminated so rapidly, and are consequently less active as diuretics. They are not nearly so powerful solvents of uric acid, and are therefore inferior to the potassium salts in gout. Indeed, the nodules, known as "chalk-stones," frequently found upon the joints of gouty patients are composed of urate of sodium.

LITHIUM SALTS closely resemble in their effects those of potassium, their action upon the nerves and muscles, however, being less powerful. The contractile force of muscle is invariably diminished by lithium and increased by potassium. As a solvent of uric acid, lithium is the most powerful of all the alkalies, the urates, formed under the administration of the carbonate or citrate, being extremely soluble, rendering the alkaline salts of lithium superior to the other alkalies in gout and in the uric-acid diathesis.

CALCIUM SALTS are more sedative and astringent in their action upon the gastro-intestinal tract than the other alkalies, and are direct antacids. They tend to produce constipation. The nervous and muscular systems are less affected by these salts than by the remaining alkalies, the contractile muscular force, however, being increased by calcium. They are less readily absorbed and excreted than the foregoing alkalies, and less active in increasing the alkalinity of the urine.

MAGNESIUM SALTS.—Magnesia and the magnesium carbonates are direct antacids and sedative to the stomach, acting upon the intestinal canal as saline cathartics. In their influence upon the circulatory system they are feebler than, but similar to, the potassium salts, slightly increasing the alkalinity of the blood. They

are not so readily absorbed, nor so rapidly excreted, as the salts of potassium and sodium, while increasing the amount of water and solids excreted and acting as solvents of uric acid.

AMMONIUM SALTS.—These preparations are used rather as cardiac stimulants, their physiological action being more extensively considered under that group. As antacids their action may be briefly compared with that of the other alkalies. Their effect upon the gastric juice and its secretion is similar to that of the carbonates and bicarbonates above mentioned. They dilate the blood-vessels of the stomach, augmenting the blood-supply and producing a sensation of warmth in the epigastrium. Lethal doses act as emetics. They increase the glycogenic function of the liver and stimulate the circulatory system, elevating the pulse-rate and raising arterial tension. In medicinal doses they stimulate the spinal cord, motor nerves, and muscles, while toxic doses paralyze these structures. They prevent the coagulation of the blood and lessen the oxygen-carrying power of the red corpuscles. By them also the respirations are increased in frequency.

The salts of ammonium are quickly absorbed and undergo oxidation in the body, augmenting the amount of uric acid and urea in the urine, thereby increasing its acidity to some extent.

As regards the poisonous activity of the alkalies mentioned, ammonium ranks next to potassium, the most toxic of all.

Therapeutics.—*Externally and Locally.*—Norton has recommended LIQUOR POTASSÆ in *ingrowing toe-nail*, the solution being applied to the nail, which is soon rendered so soft that it can be easily scraped without causing pain. The same remedy is used in many *diseases of the skin* to allay itching and soften the horny epithelium. It is also employed extensively in *diseases of the ear* and *throat*, and in the proportion of 1 part to 10 of water it is very effective in softening *impacted cerumen*.

The POTASSIUM CARBONATE in solution is frequently used in various *pruriginous diseases of the skin*, being a highly efficient antipruritic.

The detergent and sialagogue properties of POTASSIUM CITRATE and TARTRATE are rendered serviceable in certain *diseases of the mouth*.

SODIUM BICARBONATE is a deservedly popular dressing for *burns*, and *pain and swelling of the joints* in *acute articular rheumatism* are sometimes greatly relieved by enveloping the articulations in a hot solution rendered alkaline with this salt. T. Michailoff highly recommends sodium bicarbonate in *granular tonsillitis* and *pharyngitis*, the powdered salt being applied every two or three hours.

In *diseases of the ear* it is used for the same purposes as the potassium preparations above mentioned. It is one of the ingredients of "Dobell's Solution," which is an effective antiseptic wash in *nasal catarrh*, and the solution of sodium bicarbonate has been suggested by Forchheimer as a valuable remedy in *thrush* or *aphtha*.

SODIUM CARBONATE may be used for the same purposes as the bicarbonate, though probably inferior to it in all cases save *infantile eczema capitis*, in which condition it is a most valuable remedy for softening the eczematous crusts.

PREPARED CHALK is an ingredient of many ointments used in the treatment of *erysipelas* and *subacute eczema*. LIME WATER, mixed with equal parts of linseed or olive oil, is highly prized as a dressing for *burns*, and the efficiency of the "black" and "yellow" washes in the treatment of venereal sores is too well known to require further testimony in their favor. These latter preparations also make excellent applications in *acute eczema*. Lime water may sometimes be used with advantage in *leucorrhea* and *vaginitis*.

LITHII CARBONAS, in the proportion of 5 grains (0.3 Gm.) to 1 ounce (30.0 Cc.) of water, is highly recommended by Garrod for the removal of *gouty deposits*, the solution being kept constantly applied to the parts by means of lint or absorbent cotton.

MAGNESIUM CARBONATE makes an efficient dusting powder in *dermatitis* and *irritable conditions of the skin*. AMMONIUM CARBONATE mixed with lanolin readily dissolves the epidermic scales of *psoriasis*, and the AROMATIC SPIRIT OF AMMONIA is a grateful application to the scalp in *pityriasis*.

Internally.—Digestive System.—The carbonates and bicarbonates, when given before meals, serve to increase the flow of gastric juice. They act as sedatives to the stomach, particularly in *painful conditions* arising from a *deficient secretion of gastric juice*. As antacids, when given after meals, they are very useful in counteracting *excessive acidity of the stomach*. The acidity due to the formation of fatty acids, the result of defective digestion, is not relieved by the administration of these salts after meals, but if taken before meals they are valuable in correcting the deficiency of gastric secretion to which the disordered digestion is due. In *atonic dyspepsia* these preparations administered with vegetable bitters serve a useful purpose.

The bicarbonates and the salts of the vegetable acids, by increasing the alkalinity of the blood, are of great value in *gout*, the lithia salts being the most efficient in this condition. They are also of

great benefit in the treatment of *acute rheumatism*. The extensive experience of the author in connection with the latter disease justifies the belief that in the treatment of it alkalies are far superior to any other drugs, salicylic acid not excepted. It is necessary to saturate the system with some bland alkali, preferably a sodium salt, that the pernicious effects of the increased amount of uric acid formed may be rendered nugatory until convalescence shall have become assured. Thorough alkalinization should be produced and maintained, so that the sweat, saliva, and urine, which are acid in acute rheumatism, shall give no acid reaction to blue litmus-paper.

While it is admitted that the treatment of acute rheumatism by alkalies alone will not shorten the course of the disease so readily as the employment of salicylates, there is certainly less danger of heart-complications, the period of convalescence is reduced, and the tendency to relapse lessened by the use of alkaline remedies.

Even in *chronic rheumatism* where no serious renal derangements exist the mild alkalies, which are well borne by the stomach, are undoubtedly indicated, since it is well known that in chronically rheumatic subjects there is a decidedly lessened alkalinity of the blood. It is, perhaps, unnecessary to add that in the treatment of these cases proper hygiene, food, and cholagogues are important adjuncts to successful management. The author is disposed to go still further and urgently recommend complete alkalinization of the system, in connection with other therapeutic measures, in dealing with *rheumatoid arthritis*.

The acetates, bitartrates, and citrates are efficient diuretics, cathartics, and diaphoretics, the first-named salts being superior diuretics, the POTASSIUM BITARTRATE a reliable cathartic, and the citrates active diaphoretics.

In *lithemia* these salts serve a valuable purpose by rendering the urine persistently alkaline, retarding the formation of *uric-acid calculi*, and even dissolving small calculi of this variety.

In *chronic Bright's disease* the acetates and citrates are frequently indicated for their diuretic action, while POTASSIUM BITARTRATE is one of the most effective cathartics and diuretics in *acute nephritis* and *cardiac dropsy*.

LIME WATER is a useful remedy for *vomiting*—whether due to irritability, gastric ulcer, or cancer—and is also valuable in checking this symptom in *pulmonary tuberculosis*. It is an important adjunct to milk, in preventing the formation of curds and relieving *infantile vomiting*.

In the *acute mycotic diarrhea* of children, characterized by acid gastro-intestinal fermentation, the above combination is extremely useful. The symptoms also of *chronic diarrhea* and *dysentery* are often mitigated by this simple remedy. In *rachitis* and *osteomalacia* it has in certain cases appeared to be beneficial.

LIME WATER is without doubt a very efficient remedy in *diabetes insipidus*, and may also exert a favorable influence in *chronic bronchitis* by checking and otherwise modifying the mucous secretion. It should be remembered that this preparation is a valuable antidote in *arsenical poisoning*. The syrup of lime is a very inferior remedy, the sugar which it contains neutralizing the beneficial action which the lime alone might exert.

PREPARED CHALK, or CHALK MIXTURE, is useful in relieving the *premonitory diarrhea of cholera*, and *simple diarrheas of children*, with greenish acid stools and flatulent distention of the abdomen, are greatly benefited by this preparation. It is very necessary, however, that the chalk mixture be freshly prepared, the cinnamon water it contains being liable with age to fungoid contamination, and the propagation of microörganisms, which might seriously aggravate the condition for which the remedy is given, occasioning vomiting, etc.

MAGNESIA is an invaluable antacid in gastric disorders, and especially in *aphthæ* attending infantile diarrhea.

As above stated, the LITHIUM PREPARATIONS are unquestionably superior to the other alkalies in the *gouty* and *uric-acid diatheses*.

The AMMONIUM PREPARATIONS are useful antacids, being particularly efficacious in the *dyspepsia* of *drunkards* to allay nausea and vomiting, render the mucus less viscid, and act as stimulants to the circulation. Their excitant qualities, together with their property of modifying the mucous secretion, render them also of value in appropriate cases of *subacute* and *chronic bronchitis*. The remaining important uses of the ammonium preparations will be considered under "Cardiac Stimulants."

In conclusion, it may be well to mention the value of alkalies in *aiding the digestion of fats*, and as efficient remedies in the dyspepsia and indigestion from which obese, gouty, and rheumatic subjects frequently suffer.

The virtue and uses of mineral waters will be fully discussed in the following group devoted to the subject.

Contraindications.—Alkalies are contraindicated in the phosphatic diathesis, since there is danger of the formation of phosphatic

calculi. The calcium preparations should not be given to patients suffering from oxaluria.

Administration.—The alkalies should invariably be administered largely diluted, thus favoring absorption and preventing their irritant action upon the gastro-intestinal mucous membrane. The time of administration—whether before or after meals—will depend entirely upon the effect desired, a thorough knowledge of their action as above given being necessary to an intelligent and proper use of the various preparations.

GROUP VI.—MINERAL WATERS.

THE line of demarcation between mineral and ordinary waters cannot be definitely drawn. Although in the former there is usually present an excess of mineral constituents or of temperature, some drinking waters contain more mineral ingredients than others, while many very pure waters, both cold and warm, have been regarded for ages as mineral springs. As Pliny observed, waters are such as the soil through which they flow, it being a matter of observation that chalk or limestone formations, for instance, naturally impregnate with their normal constituents the springs originating in them. Still, it is impossible to determine with certainty the depth from which these waters flow, or to ascertain the various distances from the surface at which they assimilate foreign ingredients.

Nor are the geographical distribution and altitude of mineral springs less remarkable than the diversity of their constituents. Although especially abundant in volcanic regions, mineral springs are by no means confined to them. They have been found on alpine heights—even at the snow-line in the Himalayas—and they rise from the bottom of the sea, as at Baiæ and Ischia.

The foreign ingredients of mineral waters, as shown by analysis, are very numerous, some of them occurring in exceedingly minute, others in large, quantities. Among them are soda, magnesium, calcium, potash, alumina, iron, boron, iodine, bromine, arsenic, lithium, cesium, rubidium, fluorine, barium, copper, zinc, manganese, strontium, silica, phosphorus, besides extractive substances and various organic deposits known under various names. The constituent gases include carbonic and hydrosulphuric acids, nitrogen, oxygen, hydrogen, and ammonia. Of all these, by far the

most important from a therapeutic point of view are sodium, magnesium, iron, carbonic acid, sulphur, and perhaps hydrosulphuric acid. The various substances detected separately by chemists are in their analyses combined by them into various salts—if not with absolute certainty, undoubtedly with a close approximation to it.

These combinations are very numerous, some waters containing from 10 to 20 per cent. of them; yet there are always certain predominating constituents which mark the character of the spring, while many substances, such as cesium, rubidium, or fluorine, occur in mere traces and must be regarded as unimportant.

Mineral waters may be considered, therefore, as weaker or stronger solutions of salts and gases of higher or lower temperature, although the quantity of saline ingredients commonly bears but a very small proportion to that of the fluids containing them. For purposes of therapy they are used either externally in the form of baths or internally as beverages. With regard to the former use—or, to speak technically, balneotherapy—the scope of the present work precludes treatment *in extenso.* Enough to say that in certain conditions the system is undoubtedly benefited by resort to baths of various characters, especially when accompanied by the accessory aid of well-considered diet and regimen.

The literature connected with the subject of potable waters is voluminous, yet the deductions drawn by various observers touching their efficacy and in relation to the comparative value of natural springs are too frequently colored by individual bias, or based upon too hasty analysis to furnish infallible data or warrant the definite statement possible in ordinary therapeutics. That certain waters charged with foreign ingredients when ingested react upon the system favorably in the case of certain disorders it were futile to deny. Yet even here there are subsidiary considerations not to be ignored; and it is an open question how far the patient may be relieved by the potency of the remedy *per se*, or whether the collateral aids of environment, climate, altitude, temperature, etc. may not have an important bearing upon beneficial results.

It has been well observed that in the case of water taken *in situ* the curative atmosphere of the surroundings, the favorable season of the year, the reflex influence of social amenities, and freedom from customary cares, aided by studied regimen under constant medical supervision, play no unimportant part in the alleviation of positive or imaginary disorders. The maxim, "Amuse the patient and let nature work the cure," seems not wholly inapplicable to

many fashionable resorts where a constant round of gayety acts as a practical, though imperceptible, tonic or stimulant upon subjects of certain nervous susceptibilities. These considerations are no less forcible in the case of American "watering-places" than in those of the more famous resorts of Europe.

Various attempts have been made to range mineral waters according to their therapeutic action, their external and internal effects physiologically, and, most frequently, according to their chemical composition. Yet their influence is so dependent upon idiosyncrasy and their constituents so varied that it is wellnigh impossible to select a definite system free from objections, although a scientific classification, uniformly adopted, would undoubtedly promote their rational employment. Many sulphur waters are practically earthy or saline ones, yet the presence of minute quantities of hydrosulphuric acid, an ingredient so palpable as always to attract attention, has determined a classification obviously at variance with natural fact. The general rule has been to class waters under the head of their predominating elements, the desideratum being comparative simplicity untrammelled by theoretical considerations. In this view perhaps the most convenient arrangement of native mineral springs is that subjoined, adopted by Dr. A. N. Bell and widely accepted by writers on therapeutics:

Alkaline.—These waters owe their chief therapeutic value to the alkaline salts they contain. They are rich in alkaline carbonates, especially the sodium carbonate. Other substances are included among their ingredients, many of them strongly charged with carbonic-acid gas, which may possibly contribute to their physiological activity.

Saline.—These either contain (1) chloride of sodium as the principal ingredient, or (2) are largely impregnated with the sulphates of sodium and magnesium. Several other ingredients enter into their composition, yet their efficacy chiefly depends upon their predominating elements: the second class includes the bitter or purgative waters highly prized both in this country and abroad.

Sulphuretted.—The sulphuretted hydrogen present in these waters lends to them their chief therapeutic value. They contain also various sulphides—of potassium, sodium, calcium, and magnesium—together with earthy and other sulphates, which doubtless contribute in a measure to their potency as physiological agents, although their action upon the system is still a matter of conjecture.

Chalybeate. — Many mineral springs contain iron, yet in amounts so insignificant as to be of little value to therapy. There are, however, chalybeate waters highly charged with iron salts in the form of the carbonate or sulphate which have acquired a reputation for efficacy in the treatment of certain diseases.

Acidulous.—The valuable property of these springs lies in the superabundance of carbonic-acid gas they contain, to which the solid constituents are subordinate, the carbon dioxide being the important therapeutic ingredient.

Calcareous.—Calcium, in the form of the carbonate, is the valuable constituent of calcareous waters. Besides this substance they contain magnesium carbonate in varying quantities. Their utility as mineral waters has been questioned, many authorities refusing them recognition as therapeutic agents.

The following enumeration of native springs is from the admirable list compiled by Dr. A. N. Bell:

Alkaline:

Adams, California.
Albury, Vermont.
Alum, Virginia.
Borax, California.
Blount, Alabama.
Berkshire, Vermont.
Cañon City, Colorado.
Carlisle, Colorado.
Congress, California.
Elgin, Vermont.
Fry's Soda, California.
Highland, California.
Highgate, Vermont.
Lower Soda, California.
Milford, New Hampshire.
Manitou, Colorado.
Middletown, Vermont.
Napa Soda, California.
Newbury, Vermont.
Perry, Illinois.
Rocky Mountain, Colorado.
Ravenden, Arkansas.
South Park, Colorado.
Summit Soda, California.
Seltzer, California.
Sheldon, Vermont.
Vichy, California.
Wilholt Soda, California.

Calcic:

Bethesda, Wisconsin.
Butterworth, Michigan.
Birch-Dale, Vermont.
Clarendon, Vermont.
Eaton Rapid, Michigan.
Gettysburg, Pennsylvania.
Hubbardstown, Michigan.
Silurian, Wisconsin.

Chalybeate:

Abbeville, South Carolina.
Bedford, Pennsylvania.
Blossburg, Pennsylvania.
Cooper's Well, Mississippi.
Esbitt, Kentucky.
Fayette, Pennsylvania.
Gordon's, Georgia.

Greencastle, Indiana.
Kittrell's, North Carolina.
Madison, Georgia.
Manley, North Carolina.
Milford, New Hampshire.
Montvale, Tennessee.
Owasso, Michigan.
Rowland's, Georgia.
Schooley's Mountain, New Jersey.
Schuyler County, Illinois.
Sparta, Wisconsin.
Versailles, Indiana.

Purgative Saline:

Blue Lick, Kentucky.
Crab Orchard, Kentucky.
Elgin, Vermont.
Esculapian, Kentucky.
Harrodsburg, Kentucky.
Midland, Michigan.
Pagosa, Colorado.

Saline:

Fruit-Port Well, Michigan.
Grand Haven, Michigan.
Louisville Artesian, Kentucky.
Michigan Congress, Michigan.
Mt. Clemens, Michigan.
Ocean, Alabama.
Salt, Virginia.
Spring Lake Well, Michigan.
St. Louis, Missouri.

Sulphurous:

Alpena, Michigan.
Balston, New York.
Bladon, Florida.
Blue Lick, Kentucky.
Carlisle, Pennsylvania.
De Soto, Louisiana.
Dremion, Kentucky.
French Lick, Indiana.
Glenn's, South Carolina.
Highgate, Vermont.
Indian, Georgia.
Indian, Indiana.
Lodi Artesian, Indiana.
Manley, North Carolina.
Minnequa, Pennsylvania.
Montesano, Missouri.
Olympian, Kentucky.
Portea Springs, Colorado.
Salt Sulphur, Virginia.
Saratoga, New York.
Sharon, New York.
Sheldon, Vermont.
Shocco, North Carolina.
St. Helena White Sulphur, California.
St. Louis, Michigan.
Sweet, Missouri.
Valhemosa, Alabama.
West Baden, Indiana.
White Sulphur, Louisiana.
White Sulphur, Montana.
White Sulphur, Virginia.

Unclassified:

Alum, Virginia.
Birch-Dale, New Hampshire.
Borax, California.
Climax, Missouri.
Eureka, Arkansas.
Fairview, Texas.
Greeneleone, Florida.
Geysers, the American, Wyoming.
Geyser Spa, California.
Iodide and Bromide, Missouri.
Piedmont, Texas.
Stafford, Connecticut.

Summit, Maine.
Sheldon, Vermont.

Thermal Springs:

Agua Caliente, New Mexico.
Arrow-Head, California.
Buncombe County, North Carolina.
Calistoga, California.
Chalk Creek Hot, Colorado.
Charleston Artesian, South Carolina.
Des Cahutes Hot, Oregon.
Harbines, California.
Hot Springs, Arkansas.
Idaho Hot, Colorado.
Merriweather, Georgia.
Middle Park Hot, Colorado.
Ojo Caliente, New Mexico.
Paraiso, California.
Passo Robles, California.
Salt Lake, Utah.
Seigler, California.
Skaggs, California.
Volcano, Nebraska.
Warm and Hot, West Virginia.

GROUP VII.—BITTERS.

SIMPLE BITTERS.

Quăssia—Quăssiæ—Quassia. *U. S. P.*

Origin.—The wood of *Picræna excelsa* Swz., a tree resembling the common ash, attaining a height of from 60 to 80 feet (18–24 M.), indigenous in Jamaica.

Description and Properties.—In the shops it is usually met with in the form of chips or raspings of a yellowish-white color. Quassia contains two bitter principles—*quassin* and *picrasmin*. It contains *no tannin*.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Extrăctum Quăssiæ—Extrăcti Quăssiæ—Extract of Quassia.—*Dose*, 1–3 grains (0.065–0.2 Gm.).

Extrăctum Quăssiæ Flŭidum—Extrăcti Quăssiæ Flŭidi—Fluid Extract of Quassia.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Tinctūra Quăssiæ—Tinctūræ Quăssiæ—Tincture of Quassia.—*Dose*, ½–2 fluidrachms (2.0–7.3 Cc.).

Gentiāna—Gentiānæ—Gentian. *U. S. P.*

Origin.—The root of *Gentiana lutea* L., a plant from 2 to 3 feet high, indigenous in the mountainous portions of Central Europe.

Description and Properties.—It appears in nearly cylindrical pieces or longitudinal slices about 1 inch (25 Mm.) thick, the upper portion closely annulate, the lower longitudinally wrinkled; externally deep yellowish-brown; internally lighter; somewhat flexible

and rather thick, separated from the subspongiose meditullium by a black cambium line. Odor peculiar, faint, stronger when moistened; taste sweetish and persistently bitter. Gentian contains a bitter principle, *gentiopicrin*, and also *gentisic acid*, to which its yellow color is due. It contains about 15 per cent. of glucose, but *no starch* or *tannin*.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparations.

Extrăctum Gentiānæ—Extrăcti Gentiānæ—Extract of Gentian.—*Dose*, 2–10 grains (0.12–0.6 Gm.).

Extrăctum Gentiānæ Flūidum—Extrăcti Gentiānæ Flūidi—Fluid Extract of Gentian.—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Tinctūra Gentiānæ Compŏsita—Tinctūræ Gentiānæ Compŏsitæ—Compound Tincture of Gentian.—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.). 10 per cent. with Orange Peel and Cardamom.

Calŭmba—Calŭmbæ—Calumba. *U. S. P.*

(Columbo.)

Origin.—The root of *Jateorhiza palmata*, Lam., a plant native to the forests of Eastern Africa and Madagascar, and cultivated in the East Indies.

Description and Properties.—Nearly circular disks 1 to 2 inches (25–50 Mm.) in diameter and $\frac{1}{2}$ to $\frac{1}{4}$ inch (6–12 Mm.) thick. Externally greenish-brown and wrinkled; internally yellowish or grayish-yellow; depressed in the center, with a few interrupted circles of projecting wood-bundles; distinctly radiate in the outer portion; fracture short, mealy; odor slight; taste mucilaginous, slightly aromatic, very bitter. It contains a bitter crystalline principle, *calumbin*, *calumbic acid*, *berberine*, and starch. *No tannin* is present.

Dose.—10–60 grains (0.6–4.0 Gm.).

Official Preparations.

Extrăctum Calŭmbæ Flūidum—Extrăcti Calŭmbæ Flūidi—Fluid Extract of Calumba.—*Dose*, 10–60 minims (0.6–4.0 Cc.).

Tinctūra Calŭmbæ—Tinctūræ Calŭmbæ—Tincture of Calumba.—*Dose*, 1–4 fluidrachms (4.0–15. Cc.).

Calĕndula—Calĕndulæ—Calendula. *U. S. P.*

(Marigold.)

Origin.—The florets of *Calendula officinalis* L., an annual plant, a native of the Levant and Europe, frequently cultivated as a garden ornament.

Description and Properties.—Florets about $\frac{1}{2}$ inch (12 Mm.) long, linear and strap-shaped, delicately veined longitudinally, yellow or orange-colored, three-toothed at the apex, the short, hairy tube enclosing the remnants of a filiform style elongately cleft. Odor slight and somewhat heavy; taste rather bitter and faintly saline. It contains a peculiar gummy principle, *calendulin*, a bitter constituent, and a trace of volatile oil.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparation.

Tinctūra Calĕndulæ—Tinctūræ Calĕndulæ—Tincture of Calendula.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Unofficial Preparation.

Extrăctum Calĕndulæ Flūidum—Extrăcti Calĕndulæ Flūidi—Fluid Extract of Calendula.—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Chirāta—Chirātæ—Chirata. *U. S. P.*

Origin.—The entire plant, *Swertia chirata* Hamilton, an annual, native to Northern India.

Description and Properties.—Chirata as found in the shops consists of short sections of the stem and branches pressed and split, brown or dark-purple in color, and mixed with a few leaves and flowers. It contains a very bitter yellow principle, a hygroscopic powder, *chiratin*, a bitter syrupy liquid, *ophelic acid*, a resin, coloring matter, etc. No tannin is present.

Dose.—5–20 grains (0.3–1.3 Gm.).

Official Preparations.

Extrăctum Chirātæ Flūidum—Extrăcti Chirātæ Flūidi—Fluid Extract of Chirata.—*Dose*, 5–20 minims (0.3–1.3 Cc.).

Tinctūra Chirātæ—Tinctūræ Chirātæ—Tincture of Chirata.—*Dose*, $\frac{1}{2}$–1 fluidrachm (2.0–4.0 Cc.).

AROMATIC BITTERS.

Ănthemis—Anthĕmidis—Anthemis. *U. S. P.*

(Chamomile.)

Origin.—The flower-heads of *Anthemis nobilis* L., a low perennial plant indigenous in Southern and Western Europe.

Description and Properties.—Heads subglobular, about $\frac{3}{4}$ inch (2 Cm.) broad, consisting of an imbricated involucre and numerous white, strap-shaped, three-toothed florets, and a few, if any, yellow

tubular disk-florets, inserted upon a chaffy, conical, solid receptacle; of a strong, agreeable odor and an aromatic, bitter taste. Anthemis contains a bitter principle, a pale-blue or yellowish-brown volatile oil, and a trace of tannin, together with other unimportant constituents.

Dose.—15–60 grains (1.0–4.0 Gm.), in infusion or fluid extract.

Cascarilla—Cascarillæ—Cascarilla. *U. S. P.*

Origin.—The bark of *Croton eluteria*, Bennett, a small shrub indigenous in the Bahama Islands.

Description and Properties.—Quills or curved pieces about $\frac{1}{12}$ inch (2 Mm.) thick, having a grayish, somewhat fissured, easily detached, corky layer, more or less coated with a white lichen, the uncoated surface being dull brown, the inner surface being smooth. The bark breaks with a short fracture, having a resinous and radially striate appearance. When burned it emits a strong, aromatic, somewhat musk-like odor; taste warm and very bitter. It contains a *volatile oil*, a bitter, crystalline principle, *cascarillin*, tannin, resin, etc.

Dose.—10–30 grains (0.6–2.0 Gm.), or 10–30 minims (0.6–2.0 Cc.) of the fluid extract.

Prūnus Virginiāna—Prūni Virginiānæ—Wild Cherry. *U. S. P.*

Origin.—The bark, collected in autumn, of *Prunus serotina* Ehr, a large forest tree indigenous in North America.

Description and Properties.—It is met with in curved pieces or irregular fragments $\frac{1}{12}$ inch (2 Mm.) or more thick; outer surface greenish-brown or yellowish-brown, smooth and somewhat glossy, marked with transverse scars. If the bark is collected from the old wood and deprived of the corky layer, the outer surface is nut-brown and uneven; inner surface somewhat striate or fissured. Upon maceration in water it develops a distinct bitter-almond odor. Taste astringent, aromatic, and bitter. It contains a *volatile oil*, *hydrocyanic acid*, tannin, a bitter glucoside, resin, etc.

Dose.—$\frac{1}{2}$–1 drachm (2.0–4.0 Gm.).

Official Preparations.

Extractum Prūni Virginiānæ Flūidum—Extracti Prūni Virginiānæ Flūidi—Fluid Extract of Wild Cherry.—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Infūsum Prūni Virginiānæ—Infūsi Prūni Virginiānæ—Infusion of Wild Cherry.—*Dose*, 1–2 fluidounces (30.0–60.0 Cc.).

Sȳrupus Prūni Virginiānæ—Sȳrupi Prūni Virginiānæ—Syrup of Wild Cherry.—*Dose*, 2–4 fluidrachms (8.0–15. Cc.).

Serpentāria—Serpentāriæ—Serpentaria. *U. S. P.*

(Virginia Snake-root.)

Origin.—The rhizome and roots of *Aristolochia serpentaria* L., and of *Aristolochia reticulata* Nutt., perennial herbs indigenous in the United States.

Description and Properties.—The rhizome is about 1 inch (25 Mm.) long, thin, curved; on the upper side with approximate, short stem-bases; on the lower side with numerous thin, branching roots about 4 inches (10 Cm.) long; dull yellowish-brown, internally whitish; the wood-rays of the rhizome are longest on the lower side; odor aromatic, camphoraceous; taste warm, bitterish, and camphoraceous. It contains ½ per cent. of *volatile oil*, a bitterish principle, *aristolochine*, tannin, resin, starch, etc. The roots of *Aristolochia reticulata* are coarser, longer, and less interlaced than those of *Aristolochia serpentaria*.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Extrăctum Serpentāriæ Flūidum—Extrăcti Serpentāriæ Flūidi—Fluid Extract of Serpentaria.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Tinctūra Cinchōnæ Compŏsita—Tinctūræ Cinchōnæ Compŏsitæ—Compound Tincture of Cinchona.—*Dose*, 1–4 fluidrachms (4.0–15. Cc.) (2 per cent. of serpentaria.)

Tinctūra Serpentāriæ—Tinctūræ Serpentāriæ—Tincture of Serpentaria.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Antagonists and Incompatibles.—The salts of iron, lead, and silver are incompatible with gentian and the aromatic bitters, though preparations of iron can be given with quassia, calumba, and chirata. Boiling water impairs the virtues of wild cherry.

Synergists.—The digestants, mineral acids, and, under certain conditions, alkalies, and the restorative agents generally, aid the action of vegetable bitters.

Physiological Action.—Because of their action in augmenting the secretions from the salivary and gastric glands, aiding digestion and improving nutrition, Vegetable Bitters are classed among Restoratives. By increasing the activity of the various glands they

aid digestion, and by their effect upon the nerves they stimulate the appetite.

Pure bitters act immediately upon contact; that is, their efficiency is due to their local action upon the mucous membrane of the gastro-intestinal tract, with which they are brought into direct contact. There are certain drugs, however—such as cinchona, nux vomica, etc.—which act also upon the blood or remote parts of the system. When used as bitters we are concerned only with the local action of these agents.

I. Bitters increase the secretion from the salivary glands. This effect is produced by stimulating the ends of the nerves of taste distributed in the mucous membrane of the mouth, from which nerves the impression is conveyed to the center in the medulla, and from there transmitted to the vaso-motor and secretory nerves supplying the salivary glands, increasing their blood-supply and activity, and at once promoting the secretion of saliva. Were salivary secretion stimulated by the drug entering the circulation, and through the blood exciting the medulla and the glands, a much longer time would elapse before an increased flow of saliva would be produced. It is therefore certain that the rapid reflex excitation of the glands, and consequent immediate increase in the salivary secretion, are due to direct contact with the nerve-endings in the mucous membrane of the mouth. The accompanying diagram (Fig. 1) will serve to elucidate the action named.

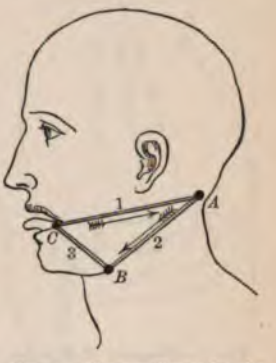

FIG. 1.—Diagram illustrating the action of bitters on the salivary glands: 1, nerve conveying the impression from the mucous membrane of the mouth (*C*) to the medulla (*A*); 2, secretory nerve transmitting the impression from the medulla (*A*) to the salivary gland (*B*); 3, duct of the salivary gland.

II. Bitters increase the secretion from the gastric glands. The primary action is an augmented flow of gastric juice, caused by reflex stimulation from the mouth. It is well known that there is an intimate relationship between the stomach and the senses of taste and smell. The taste of victuals or the odor of a tempting dinner excites the appetite, and, reflexly, the flow of gastric juice, similar to the flow of saliva in a dog looking wistfully at a meat-stand. Bitters act in a similar manner. The nerves of taste are stimulated; the impression is conveyed to the medulla, and from it transmitted not only to the salivary glands, but through the fibers of

the vagus, increasing the blood-supply to the gastric glands and thereby promoting their functional activity.

When the bitters have been swallowed, an increased secretion ensues, occasioned by direct stimulation of the mucous membrane of the stomach. Through the sensory fibers of the vagus the impression is conveyed to the center in the medulla, returning by the vaso-motor and secretory fibers, and increasing the functional activity of the glands. This action is well shown in the diagram (Fig. 2).

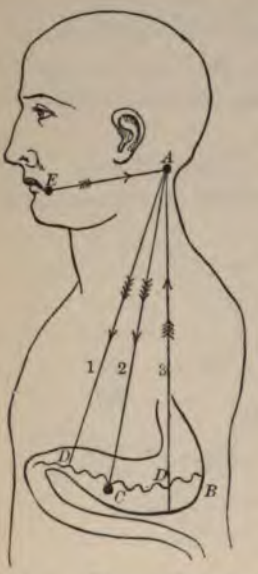

FIG. 2.—Diagram illustrating the action of bitters on the gastric secretion: *A*, medulla; *B*, stomach; *C*, gland; *D*,*D*, blood-vessels supplying the gland; *E*, nerves of taste; 1, vaso-motor fibers; 2, secretory fibers; 3, sensory fibers.

When too large a dose of bitters has been taken, or under prolonged medicinal dosage—when contraindicated by an irritable stomach—the effects are a diminished secretion of gastric juice and a corresponding increase in the secretion of mucus. This effect of over-stimulation or irritation is well illustrated in persons addicted to the excessive use of alcohol, a moderate amount promoting the secretion of gastric juice and improving the appetite, while excess occasions nausea and the vomiting of glairy mucus.

The theory governing the above action is that a medicinal dose of bitters is just sufficient to stimulate the functional activity of the gastric glands, but that immoderate or continuous dosage tends to convey the impression farther up in the medulla, causing stimulation of the vaso-constrictor fibers, contracting the blood-vessels, and lessening the blood-supply and the secretion from the glands. At the same time the secretory fibers supplying the mucous cells are stimulated, causing an increased secretion of mucus. Should the dose be sufficiently large to produce vomiting, the action is due to the fact that the impression is conveyed still higher in the medulla, and from there transmitted to the nerves supplying the abdominal walls and diaphragm, the effect being to produce emesis. The diagram (Fig. 3) graphically illustrates this action.

III. Bitters stimulate the peristaltic movements of the stomach by reflex action. The sensory nerves in the mucous membrane are

irritated, and an impression is conveyed by them to Auerbach's plexus between the muscles in the walls of the stomach, from which plexus, or ganglion, the influence is transmitted to the muscles themselves, causing increased activity or peristalsis.

Another method by which peristalsis is stimulated occurs when the impression is conveyed by the sensory nerves directly to the center in the medulla, and from there through the motor fibers of the vagus to Auerbach's plexus, affecting the muscles in the manner above described. The cut (Fig. 4) will serve to illustrate the *modus operandi.*

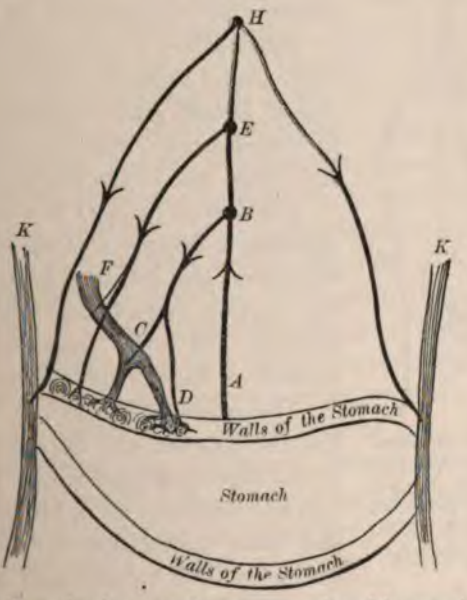

FIG. 3.—Diagram illustrating the supposed nervous connections of the stomach. A gentle stimulus applied to the walls of the stomach is transmitted by the afferent nerves (*A*) to a nerve-center (*B*), and thence along the vaso-dilating nerves (*C*) and the secreting nerves (*D*) to the vessels of the mucous membrane and the cells of the gastric follicles. A stronger stimulus is transmitted up to the nerve-center (*E*), and thence along the vaso-constricting fibers (*F*) and the secreting fibers (*G*) of the mucous follicles. A still stronger stimulus is transmitted to *H*, and thence along the motor nerves to the abdominal walls (*K*, *K*), causing them to contract and produce retching or vomiting.

IV. Bitters augment absorption by increasing the blood-supply to the mucous membrane of the stomach. It is a physiological fact that the larger the blood-supply passing through the blood-vessels, and the greater the amount of lymph conveyed through the lymph-channels, the more rapid the absorption.

V. Bitters are more or less antiseptic and arrest fermentation, both physiological and pathological. The peptonization of food is

a physiological fermentative process, forming a contraindication to the administration of bitters during active digestion.

Therapeutics.—*Externally and Locally.*—CALENDULA, in the form of a poultice, is an efficient and grateful application as a dressing to *cancer* of the breast. The tincture of calendula is recommended by many physicians as an external application for *contusions, sprains*, etc., although not so efficient as tincture of arnica. The drug has been used topically in *chronic pharyngitis* and *suppurative inflammation of the ear.*

FIG. 4.—Diagram illustrating the action of bitters upon peristalsis: *A*, medulla; *B*, stomach; *C*, Auerbach's plexus; *D*, mucous membrane; *E*, muscles; 1, motor fibers; 2, sensory fibers.

Internally.—The simple bitters are peculiarly useful in *atonic and fermentative dyspepsia, chronic gastric catarrh*, and as a tonic in *convalescence from acute disease*, in *malarial fever*, and in the *anorexia* following it.

Infusion of QUASSIA is a most efficacious injection to destroy *seat-worms* (*Oxyuris vermicularis*), the infusion being injected into the rectum, which has been previously washed out with soap and water and cleared of mucus by salines.

The aromatic bitters are used to stimulate the appetite and improve the condition of the digestive apparatus. The simple bitters are similarly used, but the former possess more stimulating and tonic properties, owing to their volatile and astringent constituents. CHAMOMILE, in addition to its action as a stimulant to the digestion, has been employed with benefit in *delirium tremens* and as an *emmenagogue*, while in the form of hot poultices chamomile flowers serve as an efficient application for *local pains.*

WILD CHERRY might not inaptly be called a sedative tonic, its peculiarly bitter yet not unpleasant taste causing it to be well tolerated by the stomach, and rendering it one of the best stomachic tonics, especially during convalescence, when its sedative action upon the heart allays febrile and cardiac excitement. The syrup of wild cherry is a common ingredient of "cough-syrups." It is thought to quiet the cough and allay the irritability of the nervous system in *bronchitis* and *phthisis*,—probably owing to the hydrocyanic acid which it contains.

SERPENTARIA is considered an efficient expectorant in *pneumonia*

and *capillary bronchitis*. Next to its use as a stomachic its chief value seems to be as a stimulant in *typhus* and *typhoid* fevers, the compound tincture of cinchona being a most excellent remedy in the low forms of typhoid. The fluid extract of serpentaria is considered somewhat of a sexual stimulant. It has been used with some success in poisoning by Rhus toxicodendron.

Contraindications.—1. Bitters should not be given when the secretion of gastric juice is diminished as the result of organic disease. 2. They are contraindicated as stomachics during the course of acute disease, as in *fevers*. 3. When, after a reasonable time, they fail to improve the appetite, they should be discontinued. 4. In convalescence from acute disease, when the appetite is voracious, they are contraindicated. 5. In catarrhal conditions of the mucous membrane of the stomach—as in chronic gastritis and "drunkards' catarrh of the stomach"—alcoholic preparations of bitters, tinctures, etc. should not be administered, aqueous preparations only, like infusions, being permissible. 6. Should the digestion be impaired and the appetite good, it is an indication that the indigestion is intestinal, and therefore beyond the influence of bitters.

Administration.—To improve the appetite bitters should be given from one-half to one hour *before* meals. When necessary to use them for a long time, one bitter should be substituted for another in the course of every week or two; otherwise the stomach may rebel at the monotony. Bitters may be given in the form of a powder or a solid extract. Ordinarily, however, it is preferable to administer a liquid preparation—fluid extract, tincture, or infusion. A pleasant method of giving the latter preparation in the case of quassia is to allow water to stand over-night or for a few hours in a quassia-cup—purchasable at almost any drug-store—when the water will become impregnated with the bitter principle of the quassia.

GROUP VIII.—HEMATICS.

PREPARATIONS OF IRON.

Fĕrrum Redŭctum—Fĕrri Redŭcti—Reduced Iron. *U. S. P.*

(Iron by Hydrogen; Quevenne's Iron.)

Origin.—Obtained by passing Hydrogen through a hot closed tube containing freshly prepared and thoroughly washed Ferric Oxide.

Description and Properties.—A very fine, grayish-black, lustreless powder, odorless and tasteless; permanent in dry air; insoluble in water or alcohol.

Dose.—1–5 grains (0.5–0.3 Gm.).

Fĕrri Carbōnas Saccharātus—Fĕrri Carbonātis Saccharāti—Saccharated Ferrous Carbonate. *U. S. P.*

Origin.—Prepared from Ferrous Sulphate, Sodium Bicarbonate, Sugar, and Distilled Water, by solution and filtration.

Description and Properties.—A greenish-brown powder gradually becoming oxidized by contact with air; without odor, and having at first a sweetish, afterward a slightly ferruginous, taste. Only partly soluble in water, but completely soluble in hydrochloric acid, with copious evolution of carbonic-acid gas, forming a clear, greenish-yellow liquid. The product should be kept in small, well-stoppered bottles.

Dose.—2–10 grains (0.12–0.6 Gm.).

Măssa Fĕrri Carbonātis—Măssæ Fĕrri Carbonātis—Mass of Ferrous Carbonate. *U. S. P.*

(Vallet's Mass.)

Origin.—Prepared by solution, filtration, and evaporation from Ferrous Sulphate, Sodium Carbonate, Clarified Honey, Sugar, Syrup, and Distilled Water.

Description and Properties.—When recently prepared the mass is of a greenish-gray color, but on exposure it becomes greenish-black.

Dose.—3–5 grains (0.15–0.3 Gm.).

Mistūra Fĕrri Compŏsita—Mistūræ Fĕrri Compŏsitæ—Compound Iron Mixture. *U. S. P.*

(Griffith's Mixture.)

Origin.—Prepared by mixing Ferrous Sulphate, Myrrh, Sugar, Potassium Carbonate, Spirit of Lavender, and Rose Water.

Description and Properties.—When newly prepared it is of a dirty greenish color, but slowly oxidizes on exposure to the air, and should therefore be freshly prepared when needed.

Dose.—½–1½ ounces (15.–45 Cc.).

Fĕrri lōdidum Saccharātum—Fĕrri lōdidi Saccharāti—Saccharated Ferrous Iodide. *U. S. P.*

Origin.—Prepared by solution, filtration, evaporation, and trituration from Iron Wire, Reduced Iron, Iodine, Distilled Water, and Sugar of Milk.

Description and Properties.—A yellowish-white or grayish, hygroscopic, odorless powder, having a sweetish, ferruginous taste. Soluble in 7 parts of water, but only partially soluble in alcohol. It should be kept in a cool, dark place, in small, perfectly dry, securely-stoppered bottles.

Dose.—5–10 grains (0.3–0.6 Gm.).

Pĭlulæ Fĕrri lōdidi—Pĭlulas (acc.) Fĕrri lōdidi—Pills of Ferrous Iodide. *U. S. P.*

Origin.—Pills made of Reduced Iron, Iodine, Glycyrrhiza, Sugar, Extract of Glycyrrhiza, Acacia, Balsam of Tolu, Water, and Ether, evaporated to pilular consistence.

Description and Properties.—These preparations are very unstable, and should be kept from the light as much as possible.

Dose.—One to two pills, each pill containing nearly 1 grain (0.061 Gm.) of ferrous iodide.

Sўrupus Fĕrri lōdidi—Sўrupi Fĕrri lōdidi—Syrup of Ferrous Iodide. *U. S. P.*

Origin.—A syrup containing 10 per cent. of Ferrous Iodide.

Description and Properties.—A transparent, pale-green liquid, having a sweet, strongly ferruginous taste and a neutral reaction.

Dose.—5–30 minims (0.3–2.0 Cc.).

Fĕrri Chlōridum—Fĕrri Chlōridi—Ferric Chloride.

Origin.—Prepared by the action of Hydrochloric Acid and Distilled Water upon Iron Wire, subsequent filtration, addition of Nitric Acid, and crystallization.

Description and Properties.—Orange-yellow, crystalline pieces, odorless or having a faint odor of hydrochloric acid, and a strongly styptic taste; very deliquescent in moist air; freely and completely soluble in water or alcohol, also in a mixture of 1 part of ether and 3 parts of alcohol. Ferric chloride should be kept in glass-stoppered bottles protected from light.

Dose.—It is chiefly used topically, as an astringent and hemostatic.

Līquor Fĕrri Chlōridi—Liquōris Fĕrri Chlōridi—Solution of Ferric Chloride. *U. S. P.*

Origin.—An aqueous solution of Ferric Chloride (Fe_2Cl_6 = 323.98), containing about 37.8 per cent. of the anhydrous salt, corresponding to 62.9 per cent. of the crystallized salt, or about 13 per cent. of metallic iron.

Description and Properties.—A reddish-brown liquid, having a faint odor of hydrochloric acid, an acid, strongly styptic taste, and an acid reaction.

Dose.—2–10 minims (0.12–0.6 Cc.), largely diluted.

Tinctūra Fĕrri Chlōridi—Tinctūræ Fĕrri Chlōridi—Tincture of Ferric Chloride. *U. S. P.*

Origin.—A hydro-alcoholic solution of Ferric Chloride, containing about 13.6 per cent. of the anhydrous salt, corresponding to about 4.7 per cent. of metallic iron.

Description and Properties.—A bright, brownish liquid having a slightly ethereal odor, a very astringent, styptic taste, and an acid reaction.

Dose.—5–30 minims (0.3–2.0 Cc.).

Līquor Fĕrri Acetātis—Liquōris Fĕrri Acetātis—Solution of Ferric Acetate. *U. S. P.*

Origin.—An aqueous solution of Ferric Acetate, containing about 31 per cent. of the anhydrous salt, corresponding to about 7.5 per cent. of metallic iron.

Description and Properties.—A dark, reddish-brown, clear liquid, of an acetous odor, a sweetish, acidulous, somewhat styptic taste, and a slightly acid reaction.

Dose.—1–8 minims (0.06–0.5 Cc.).

Līquor Fĕrri et Ammōnii Acetātis—Liquōris Fĕrri et Ammōnii Acetātis—Solution of Iron and Ammonium Acetate. *U. S. P.*

(Basham's Mixture.)

Formula.—Prepared with Tincture of Ferric Chloride, 20 parts; Diluted Acetic Acid, 30; Solution of Ammonium Acetate, 200; Aromatic Elixir, 100; Glycerin, 120; Water, to 1000.

Dose.—1–4 fluidrachms (4.0–15.0 Cc.).

Fĕrri Cĭtras—Fĕrri Citrātis—Ferric Citrate. *U. S. P.*

Origin.—Prepared by evaporating solution of Ferric Citrate on a water-bath at a temperature not exceeding 60° C. (140° F.).

Description and Properties.—Thin, transparent, garnet-red scales, without odor and having a slightly ferruginous taste. Slowly but completely soluble in cold water, and readily soluble in hot water, but diminishing in solubility with age. Insoluble in alcohol. Ferric citrate should be kept in well-stoppered bottles, protected from light.

Dose.—5–20 grains (0.3–1.20 Gm.), in solution.

Līquor Fĕrri Citrātis—Liquōris Fĕrri Citrātis—Solution of Ferric Citrate. *U. S. P.*

Origin.—Prepared by precipitating a solution of Ferric Sulphate in Water with Ammonia Water, adding Citric Acid, filtering, and evaporating the filtrate to the proper amount.

Description and Properties.—A dark-brown liquid, odorless, of an acid reaction, and possessing a slightly ferruginous taste.

Dose.—5–15 minims (0.3–1.0 Cc.).

Vīnum Fĕrri Citrātis—Vīni Fĕrri Citrātis—Wine of Ferric Citrate. *U. S. P.*

Composition.—Iron and Ammonium Citrate, Tincture of Sweet Orange Peel, Syrup, and Water.

Dose.—½–1 fluidrachm (2.0–4.0 Cc.).

Fĕrri et Ammōnii Cĭtras—Fĕrri et Ammōnii Citrātis—Iron and Ammonium Citrate. *U. S. P.*

Origin.—Prepared by evaporating a solution of Ferric Citrate and Ammonia Water.

Description and Properties.—Thin, transparent, garnet-red scales, odorless, and having a saline, mildly ferruginous taste; deliquescent in moist air. Completely soluble in water, but insoluble in alcohol.

Dose.—5–10 grains (0.3–0.6 Gm.).

Fĕrri et Quinīnæ Cĭtras—Fĕrri et Quinīnæ Citrātis—Iron and Quinine Citrate. *U. S. P.*

Origin.—Solution of Ferric Citrate in Distilled Water and solution of Quinine and Citric Acid in Distilled Water are mixed, evaporated on a water-bath to the consistence of syrup, and dried on plates of glass.

Description and Properties.—Thin, transparent scales, of a

reddish-brown color, without odor, and having a bitter, mildly ferruginous taste; slowly deliquescent in damp air. Gradually but completely soluble in cold water, more readily soluble in hot water, and but partially soluble in alcohol, its solubility diminishing with age. It should be kept in well-stoppered bottles, protected from light.

Dose.—2–10 grains (0.12–0.6 Gm.).

Fĕrri et Quinīnæ Cītras Solūbilis—Fĕrri et Quinīnæ Citrātis Solūbilis—Soluble Iron, and Quinine Citrate. *U. S. P.*

Origin.—Prepared in the same manner as the above salt, but with the addition of Ammonia Water.

Description and Properties.—Thin, transparent scales, of a greenish, golden-yellow color, odorless, and having a bitter, mildly ferruginous taste; deliquescent in damp air. Rapidly and completely soluble in cold water, but only partially soluble in alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose.—2–10 grains (0.12–0.6 Gm.).

Fĕrri et Strychnīnæ Cītras—Fĕrri et Strychnīnæ Citrātis—Iron and Strychnine Citrate. *U. S. P.*

Origin.—Solution of Iron and Ammonium Citrate in Distilled Water and solution of Strychnine and Citric Acid in Distilled Water are mixed, evaporated to the consistence of syrup by means of a water-bath, and dried on plates of glass.

Description and Properties.—Thin, transparent scales, varying in color from garnet-red to yellowish-brown, without odor, and having a bitter, slightly ferruginous taste; deliquescent in damp air. Readily and completely soluble in water, but only partly soluble in alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose.—1–3 grains (0.06–0.18 Gm.).

Vīnum Fĕrri Amārum—Vīni Fĕrri Amāri—Bitter Wine of Iron. *U. S. P.*

Composition.—Soluble Iron and Quinine Citrate, Tincture of Sweet Orange Peel, Syrup, White Wine.

Dose.—1–2 fluidrachms (4.0–8.0 Cc.).

Sȳrupus Fĕrri, Quinīnæ, et Strychnīnæ Phosphātum—Sȳrupi Fĕrri, Quinīnæ, et Strychnīnæ Phosphātum—Syrup of the Phosphates of Iron, Quinine, and Strychnine. *U. S. P.*

Dose.—1–2 fluidrachms (4.0–8.0 Cc.).

Fĕrri Lăctas—Fĕrri Lactātis—Ferrous Lactate. *U. S. P.*

Description and Properties.—Pale, greenish-white crusts, consisting of small, nĕedle-shaped crystals, having a slight, peculiar odor, and a mild, sweetish, ferruginous taste. Slowly but completely soluble in 40 parts of water and in 12 parts of boiling water; almost insoluble in alcohol. Ferrous lactate should be kept in well-stoppered bottles.

Dose.—1–3 grains (0.06–0.2 Gm.).

Sȳrupus Hypophosphītum cum Fĕrro—Sȳrupi Hypophosphītum cum Fĕrro—Syrup of Hypophosphites with Iron. *U. S. P.*

Ferrous Lactate and Potassium Citrate dissolved in Syrup of Hypophosphites.

Dose.—½–1 fluidrachm (2.0–4.0 Cc.).

Fĕrri Ŏxidum Hydrātum—Fĕrri Ŏxidi Hydrāti—Ferric Hydrate. *U. S. P.*

(Ferric Hydroxide—Hydrated Oxide of Iron.)

Origin.—To a solution of Ammonia Water in Water is added a solution of Ferric Sulphate in Water, and the precipitate collected.

Description and Properties.—A brownish-red magma, wholly soluble in hydrochloric acid, without effervescence.

Dose.—4 drachms (16 Gm.), or *ad libitum* in case of arsenical poisoning.

Fĕrri Ŏxidum Hydrātum cum Magnesiâ—Fĕrri Ŏxidi Hydrāti cum Magnesiâ—Ferric Hydrate with Magnesia. *U. S. P.*

Solution of Ferric Sulphate, Magnesia, and Water.

Dose.—Amounts as necessary *ad libitum.*

Fĕrri et Ammōnii Sŭlphas—Fĕrri et Ammōnii Sulphātis—Ferric Ammonium Sulphate. *U. S. P.*

(Ammonio-ferric Sulphate—Ammonio-ferric Alum.)

Origin.—The crystals formed by adding Ammonium Sulphate to a boiling-hot solution of Ferric Sulphate.

Description and Properties.—Pale violet, octahedral crystals, odorless, and having an acid, styptic taste; efflorescent on exposure to the air. Soluble in 3 parts of water and in 0.8 part of boiling water; insoluble in alcohol. The product should be kept in well-stoppered bottles.

Dose.—5–15 grains (0.5–1.0 Gm.).

Fĕrri et Ammōnii Tărtras—Fĕrri et Ammōnii Tartrātis—Iron and Ammonium Tartrate. *U. S. P.*

(Ammonio-ferric Tartrate.)

Description and Properties.—Thin, transparent scales, varying in color from garnet-red to reddish-brown, without odor, and having a sweetish, slightly ferruginous taste; slightly deliquescent in the air. Very soluble in water; insoluble in alcohol. Iron and ammonium tartrate should be kept in well-stoppered bottles, protected from light.

Dose.—10–30 grains (0.6–2.0 Gm.).

Fĕrri et Potăssii Tărtras—Fĕrri et Potăssii Tartrātis—Iron and Potassium Tartrate. *U. S. P.*

(Potassio-ferric Tartrate.)

Description and Properties.—Thin, transparent scales, varying in color from garnet-red to reddish-brown, without odor, and having a sweetish, slightly ferruginous taste; slightly deliquescent in the air. Very soluble in water; insoluble in alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose.—5–20 grains (0.3–1.2 Gm.).

Fĕrri Phŏsphas Solūbilis—Fĕrri Phosphātis Solūbilis—Soluble Ferric Phosphate. *U. S. P.*

Description and Properties.—Thin, bright-green, transparent scales, odorless, and having an acidulous, slightly saline taste. The salt is permanent in dry air when excluded from light, becoming dark and discolored when exposed to it. Freely and completely

soluble in water, but insoluble in alcohol. It should be kept in dark amber-colored, well-stoppered bottles.

Dose.—5–10 grains (0.3–0.6 Gm.).

Fĕrri Pyrophŏsphas Solūbilis—Fĕrri Pyrophosphātis Solūbilis—Soluble Ferric Pyrophosphate. *U. S. P.*

Description and Properties.—Thin apple-green, transparent scales, without odor, and having an acidulous, slightly saline taste; permanent in dry air if protected from light, and if exposed to it becoming dark and discolored. Freely and completely soluble in water, but insoluble in alcohol. It should be kept in dark amber-colored, well-stoppered bottles.

Dose.—2–5 grains (0.1–0.3 Gm.).

Fĕrri Hypophŏsphis—Fĕrri Hypophosphītis—Ferric Hypophosphite. *U. S. P.*

Origin.—The precipitate formed by mixing solutions of Sodium Hypophosphites and Ferric Chloride or Ferric Sulphate.

Description and Properties.—A white or grayish-white powder, odorless and nearly tasteless, permanent in the air. Only slightly soluble in water. It should be kept in well-stoppered bottles.

Dose.—5–10 grains (0.3–0.6 Gm.).

Fĕrri Valeriānas—Fĕrri Valerianātis—Ferric Valerianate. *U. S. P.*

Origin.—The precipitate obtained by adding to a cold solution of Ferric Sulphate or Ferric Chloride a cold solution of Sodium Valerianate.

Description and Properties.—A dark, brick-red, amorphous powder, of somewhat varying chemical composition, having the odor of valerianic acid and a mildly styptic taste; permanent in dry air. Insoluble in cold water, but readily soluble in alcohol. Boiling water decomposes it, setting free the valerianic acid and leaving ferric hydrate. It should be kept in small, well-stoppered bottles, in a cool, dark place.

Dose.—1–3 grains (0.06–0.18 Gm.).

Fĕrri Sŭlphas—Fĕrri Sulphātis—Ferrous Sulphate. *U. S. P.*

Origin.—Obtained by the action of Sulphuric Acid and Water upon Iron Wire.

Description and Properties.—Large, pale bluish-green monoclinic prisms, without odor, and having a saline, styptic taste; efflorescent in dry air; on exposure to moist air the crystals rapidly absorb oxygen, becoming coated with a brownish-yellow, basic ferric sulphate. Soluble in 1.8 parts of water and in 0.3 part of boiling water; insoluble in alcohol.

Dose.—1–3 grains (0.06–0.18 Gm.).

Fĕrri Sŭlphas Exsiccātus—Fĕrri Sulphātis Exsiccāti—Dried Ferrous Sulphate. *U. S. P.*

Description and Properties.—A grayish-white powder, slowly but completely soluble in water.

Dose.—½–2 grains (0.03–0.12 Gm.).

Fĕrri Sŭlphas Granulātus—Fĕrri Sulphātis Granulāti—Granulated Ferrous Sulphate. *U. S. P.*

Description and Properties.—A pale bluish-green, crystallized powder, which should conform in every respect to the reactions and tests given under Ferri Sulphas in the U. S. P.

Dose.—½–3 grains (0.03–0.18 Gm.).

Līquor Fĕrri Subsulphātis—Liquōris Fĕrri Subsulphātis—Solution of Ferric Subsulphate. *U. S. P.*

(Solution of Basic Ferric Sulphate—Monsel's Solution.)

Origin.—An aqueous solution of basic Ferric Sulphate—of varying chemical composition—corresponding to about 13.6 per cent. of metallic iron.

Description and Properties.—A dark, reddish-brown liquid, odorless or nearly so, of an acid, strongly styptic taste, and an acid reaction. Miscible with water and alcohol in all proportions, without decomposition.

Dose.—1–10 minims (0.06–0.6 Cc.), largely diluted—chiefly used, however, as a local styptic.

Līquor Fĕrri Tersulphātis—Liquōris Fĕrri Tersulphātis—Solution of Ferric Sulphate. *U. S. P.*

Origin.—An aqueous solution of normal Ferric Sulphate, containing about 28.7 per cent. of the salt, and corresponding to about 8 per cent. of metallic iron.

Description and Properties.—A dark, reddish-brown liquid, almost odorless, having an acid, strongly styptic taste, and an acid reaction. Miscible with water and alcohol in all proportions, without decomposition.

Dose.—1–10 minims (0.06–0.6 Cc.), given in the same manner and for the same purposes as the preceding preparation.

Pīlulæ Ăloes et Fĕrri—Pīlulas (acc.) Ăloes et Fĕrri—Pills of Aloes and Iron. *U. S. P.*

Described under *Aloes.*

Dose.—5–10 grains (0.3–0.6 Gm.), or two or three pills.

Emplăstrum Fĕrri—Emplăstri Fĕrri—Iron Plaster. *U. S. P.*

(Strengthening Plaster.)

Formula: Ferric Hydrate, 90; Olive Oil, 50; Burgundy Pitch, 140; Lead Plaster, 720. For external use.

Trochĭsci Fĕrri—Trochĭscos (acc.) Fĕrri—Troches of Iron. *U. S. P.*

Composition.—Ferric Hydrate; Vanilla; Sugar; Mucilage of Tragacanth.

Dose.—One to two troches, each troche containing 5 grains (0.3 Gm.) of ferric hydroxide.

Līquor Fĕrri Nitrātis—Liquōris Fĕrri Nitrātis—Solution of Ferric Nitrate. *U. S. P.*

Origin.—An aqueous solution of Ferric Nitrate, containing about 6.2 per cent. of the anhydrous salt, corresponding to about 1.4 per cent. of metallic iron.

Description and Properties.—A clear, amber-colored or reddish liquid, odorless, having an acid, styptic taste, and an acid reaction.

Dose.—5–10 minims (0.3–0.6 Cc.).

Pĭlulæ Fĕrri Carbonātis—Pĭlulas (acc.) Fĕrri Carbonātis—Pills of Ferrous Carbonate. *U. S. P.*

(Ferruginous Pills—Chalybeate Pills—Blaud's Pills.)

Dose.—2 to 5 pills, each pill containing 1 grain (0.064 Gm.) of ferrous carbonate.

Unofficial Preparations.

Tinctūra Fĕrri Acetātis—Tinctūræ Fĕrri Acetātis—Tincture of Ferric Acetate, U. S. P.—Composition: Solution of Ferric Acetate; Alcohol; Acetic Ether.

Description and Properties.—A clear, dark, reddish-brown liquid, transparent in thin layers, having the odor of acetic ether, an acidulous and astringent taste, and a slightly acid reaction. Miscible in all proportions with water, without becoming turbid. The tincture should be kept in the dark and in a cool place.

Dose.—5–30 minims (0.2–2.0 Cc.).

Fĕrri Ārsenas—Fĕrri Arsenātis—Iron Arsenate.—*Description and Properties.*—A green or blue-green, amorphous powder, insoluble in water and in alcohol.

Dose.—$\frac{1}{20}$–$\frac{1}{2}$ grain (0.003–0.03 Gm.).

Fĕrri Albūminas—Fĕrri Albuminātis—Albuminate of Iron.—*Description and Properties.*—Golden yellow, transparent scales, containing 3.34 per cent. of iron.

Dose.—5–30 grains (0.3–2.0 Gm.). A liquor and a syrup of albuminate of iron are used.

Fĕrrum Dialysātum—Fĕrri Dialysāti—Dialyzed Iron (Liquor Ferri Dialysatus—Liquor Ferri Oxychlorati).—*Description and Properties.*—Perfectly transparent, thin layers, of a deep brown-red color, inodorous, and almost destitute of styptic taste. Miscible with alcohol, glycerin, syrup, and distilled water, but not with spring-water or other, even dilute, saline solutions.

Dose.—10–30 minims (0.6–2.0 Cc.).

Līquor Fĕrri Peptonāti—Liquōris Fĕrri Peptonāti—Solution of Peptonate of Iron.—*Dose*, $\frac{1}{2}$–2 fluidrachms (2.0–8.0 Cc.).

Līquor Măngano-Fĕrri Peptonātus—Liquōris Măngano-Fĕrri Peptonāti (Gude)—**Solution of Peptonate of Iron and Manganese.**—A proprietary preparation from the formula of Dr. Gude.

Dose.—2–4 fluidrachms (8.0–15.0 Cc.).

Allied Compounds.

Hæmogallol.—*Origin.*—Prepared by the action of Pyrogallol on the coloring matter of the blood.

Description and Properties.—A reddish-brown, tasteless powder.

Dose.—1–8 grains (0.06–0.5 Gm.).

Hæmol.—*Origin.*—Prepared by the action of Zinc Dust on the coloring matter of the blood.

Description and Properties.—A blackish-brown powder having a slight taste.

Dose.—1–8 grains (0.06–0.5 Gm.).

Ferratin.—*Origin.*—A compound of Iron first obtained by Professor Schmiedeberg from hog's liver.

Description and Properties.—A fine, reddish-brown powder containing about 7 per cent. of iron. One variety is insoluble, though the sodium ferratin is freely soluble in water.

Dose.—10–20 grains (0.16–1.2 Gm.).

Hæmalbumin.—A preparation said to contain two albuminoids and salts of the blood.

Description and Properties.—A permanent powder, soluble in water and in alcohol.

Dose.—5–15 grains (0.3–1.0 Gm.).

Hæmoglobin.—Said to be the coloring principle of the solid elements of the blood.

Dose.—1–3 grains (0.06–0.18 Gm.).

Hæmoferrum.—Claimed to be a natural proteid compound of Iron obtained from bullock's blood.

Dose.—1–3 grains (0.06–0.18 Gm.).

Iron Quinine Chloride.—A yellowish-red powder, soluble in water, alcohol, and glycerin.

Dose.—1–3 grains (0.06–0.18 Gm.). Used externally as a hemostatic.

Antagonists and Incompatibles.—The ferric salts are incompatible with tannic and gallic acids and vegetable astringents, and gelatinize mucilage of acacia. The carbonates are also incompatible with tannic and mineral acids and acidulous salts.

The salts of the vegetable acids and the iodides are incompatible with mineral acids, tannic acid, and with alkalies and their carbonates. The tincture of the chloride of iron is also incompatible with tannic acid, vegetable astringents, alkalies and their carbonates, lime water, and the carbonates of calcium and magnesium.

Synergists.—All the restorative medicines are synergistic.

Physiological Action.—Iron is a typical restorative, being an essential element of the blood, there being 1 part of iron to 230 of red globules. It has also been found in the gastric juice, bile, lymph, chyle, milk, urine, pigment of the eye, etc. This omnipresence is readily accounted for when it is remembered that the food of man contains iron in variable quantities. Indeed, this useful metal may well be called a respiratory nutrient because of its property of increasing the oxygen-carrying power of the red blood-corpuscles—muscular force and functional activity generally being dependent upon the supply of oxygen, or proper respiration, as the motive power.

When the system is in a normal, healthy condition, sufficient iron is furnished by the mixed diet to answer all physiological requirements. In many diseased conditions, however, there is a deficiency of iron, and it is necessary to restore this element in one way or another.

The chief actions of iron are—1. To increase the oxygen-carrying powers of the blood; 2. To convert the oxygen present in the tissues into ozone; 3. To serve both as a local and general astringent.

The physiological effects upon the various systems, locally and internally, now to be considered, are due directly or indirectly to the principal actions above mentioned.

Externally and Locally.—Neither the ferric nor the ferrous salts exert any action upon the unbroken skin. When applied, however, to mucous membranes or denuded surfaces, they are astringent and hemostatic, the ferric salts being the more powerful, coagulating albuminous fluids. When applied to bleeding surfaces the hemostatic action is due rather to the coagulation of the blood, forming a natural barrier to its escape, than to any direct action upon the walls of the vessels. The vegetable salts—scale preparations—possess so feeble astringent properties that they are rarely, if ever, used as local applications.

The acid and astringent preparations of iron act upon the teeth. The ferric oxides are disinfectant, owing to their property of converting oxygen into ozone.

Internally.—Digestive System.—The teeth and tongue are blackened by the preparations of iron. In the stomach, when not contraindicated and in small doses, its slightly irritant and astringent properties render iron quite a valuable stomachic tonic. Under excessive doses or prolonged administration the acid preparations especially are apt to cause gastric derangement—anorexia, nausea, and serious indigestion. The ferric chloride is particularly valuable in that its ingestion does not, like that of other preparations of iron, diminish the supply of hydrochloric acid in the gastric juice.

The scale salts, though disturbing the digestion less than the acid preparations, are ordinarily inferior to the latter.

All the preparations of iron are probably converted into the chloride in the stomach. When entering the *intestines* they are converted into the ferric oxide, ferrous chloride, the alkaline albuminate, and the insoluble sulphide and tannate. Most of the iron preparations are constipating, the phosphate and pyrophosphate being exceptions. They tend to diminish the bile and the secretions from the gastro-intestinal tract.

Circulatory System.—The action of iron upon the blood is of great importance, since, the metal being a normal constituent of that fluid, its administration has a nutrient as well as a medicinal influence. A primary effect is to supply a deficiency of red corpuscles and bring the hemoglobin up to the normal standard. Iron enables the red corpuscles to convey more oxygen to the tissues, converting that element into ozone and thereby rendering it

more active in promoting oxidation. The muscular power of the heart is increased, the arterioles slightly contracted, and arterial tension somewhat raised.

Nervous System.—The general effect is tonic, the influence of iron and its salts being highly beneficial in strengthening the action of the nerves in cases of physical debility. With subjects inclined to plethora, however, certain untoward symptoms may result from administration of the stronger preparations, including a feeling of congestion in the cerebrum.

Respiratory System.—No immediate action is perceptible under normal conditions, but in anemic states, by supplying the nerve-centers, muscles, and lungs with better blood, the respiratory power is increased.

Absorption and Elimination.—Opinions differ regarding the form in which iron is absorbed. Probably much of it is converted into the soluble chloride and absorbed as such in the stomach,—while a portion, passing into the intestines, may there be converted into the soluble alkaline albuminate capable of absorption. The larger portion of iron taken into the system, however, is changed into the insoluble sulphide and tannate, and excreted as such, giving to the feces a black color. Such part of the iron as enters the circulation combines with the red corpuscles. The salts of the organic acids are absorbed directly into the blood.

Such careful pharmacologists as Bunge, Schmiedeberg, and Hamburger claim that inorganic preparations of iron are neither absorbed nor assimilated, maintaining that the blood and hemoglobin are influenced only by the organic compounds. Yet, notwithstanding these statements, clinical experience has fully demonstrated the value of such preparations as reduced iron, tincture of the chloride, carbonate, etc.; and it is still perhaps a mooted question whether appreciable amounts of them are actually absorbed, or whether, according to Bunge, the inorganic prevent the decomposition of the organic salts of iron in the food by fixing the decomposing agents in the intestines. At all events, the beneficial results in anemia and chlorosis of large doses of the inorganic preparations are too manifest to justify abandonment of these agents because of our ignorance touching their *modus operandi.*

Bunge's hypothesis would at least seem plausible when it is remembered that only traces of iron can be found in the urine when the drug is given by the stomach, while if injected into the circulation large quantities are eliminated by the kidneys. It is

quite possible that the improvement in the red corpuscles, and the promotion of oxidation independent of them, take place in the portal circulation, and that when the iron reaches the liver it is there intercepted and, together with the bile, turned back into the intestines.

The amount of urea is increased and micturition rendered more frequent by preparations of this metal.

Elimination takes place chiefly by the feces, to which a blackish color is imparted by the formation of ferrous sulphide. The bile, urine, and even the skin, as well as the mucous and serous membranes, share in the excretory process.

Temperature.—The administration of iron tends to raise bodily heat in the sick. This may be due only to the normal influence of the metal, the ozonizing power of which, affecting the promotion of tissue-waste, naturally causes an elevation of temperature.

Untoward Action.—The continued use of ferruginous preparations has a tendency to impair the normal digestive powers, occasioning even gastric oppression, nausea, and vomiting. Reduced iron, the phosphate, and the pyrophosphate produce less untoward action than other preparations, and the ferrous are better tolerated than the ferric salts. Not infrequently acne of the face, breast, and back is occasioned, while the prolonged administration of the drug may in rare cases be accompanied by hemorrhages from the mucous membranes and symptoms of plethora and vascular excitement. Large doses of the ferrous sulphate may occasion obstruction of the bowels.

Poisoning.—The ferric preparations in a concentrated form produce all the symptoms of an irritant poison—gastric pain, vomiting, etc.

Treatment of Poisoning.—The stomach should be emptied by an emetic or carefully cleansed, the treatment being followed by the administration of alkali solutions, tannic acid, and demulcent drinks, the procedure being similar to that employed in poisoning from mineral acids.

Therapeutics.—*Externally and Locally.*—The astringent and styptic properties of chlorides and sulphates of iron have rendered them serviceable in controlling hemorrhage and as local astringents in relaxed conditions of the *pharynx* and *larynx* and mucous membranes generally. The tincture of the chloride has been highly recommended as a local application to the throat in *diphtheria*, and *chronic and indolent ulcers* may often be benefited by

a wash containing from 2 to 5 grains (0.12–0.3 Gm.) of the sulphate to 1 ounce (30.0 Cc.) of water.

Internally.—The most important use of iron is to restore the number of red corpuscles and the amount of hemoglobin. In nearly every form of *anemia*, therefore, iron is indicated. In *chlorosis*, especially, it is of great value; but in order that its effects may be most beneficial cathartics, such as rhubarb and aloes, which do not weaken the intestines, should accompany its use. Even the *anemia due to hemorrhage* calls for iron; yet if the assimilative functions are not impaired, the drug should be reinforced by plenty of nutritious food, from which the constituents of the blood are normally elaborated.

The *anemia of scrofula* and *syphilis* is benefited by some form of iron, care being taken in these cases to select the proper salts. In *glandular scrofula*, for instance, the iodide is to be preferred, and, theoretically, this salt is preferable also in *syphilis*, yet in the latter disease the efficacy of the salt depends less upon its particular radical than upon its restorative properties and its power of counteracting the depressing and mischievous effects so often produced by excessive use of the remedy.

In the desquamative forms of *Bright's disease* iron is of signal benefit. In this condition the blood-disks are rapidly destroyed by the urea; moreover, certain preparations of iron possess quite a local action upon the kidney. Iron is also useful in *jaundice* where there is more or less cholemia, with destruction of the red corpuscles.

Many *nervous disorders* dependent upon anemia are relieved by iron. Even in *chorea* and various *neuralgias*—especially those of an intermittent nature arising from an impoverished state of the blood—iron is of decided value. In many *chronic nervous diseases*, however, good judgment in the use of the drug is necessary, lest it prove more prejudicial than advantageous.

In anemia of certain *cardiac diseases* iron is of unquestioned value, though the fact is well known to observant practitioners that in these cases iron alone is but a single element in the successful treatment of them.

While iron is of great service in lessening the muco-purulent expectoration of *chronic bronchitis*, its influence in *pulmonary tuberculosis* is less favorable. At times the drug appears to improve the condition of phthisical patients early in the disease, yet more frequently it induces hemoptysis and hastens the progress of the malady. In certain *disorders of the genito-urinary tract—prolapsus uteri, incon-*

tinence of urine, seminal emissions, prostatorrhea, etc.—iron is an appropriate remedy. It is an important agent in the treatment of *diabetes,* though care should be taken to guard against its tendency to constipate the bowels.

As observed later on, iron is contraindicated in febrile diseases, yet it is a matter of clinical experience that the drug acts favorably in modifying the course of *idiopathic erysipelas, pyemia, septicemia,* and *diphtheria.*

The astringent action of iron is available in the treatment of *vaginal leucorrhea, hematemesis,* and *passive hemorrhages* from the *uterus, bladder, kidneys,* etc. It has also proved highly beneficial in certain forms of *chronic diarrhea* and *dysentery.* In *amenorrhea* and *menorrhagia,* when due to a deficiency of normal blood, iron is an extremely valuable remedy.

Contraindications.—Iron is usually contraindicated in fever and acute inflammatory conditions, in anemia of malignant disease, such as cancer, in Addison's disease, and in the hemorrhagic diathesis. Should the use of iron derange digestion or aggravate hemorrhoidal conditions, the drug should be discontinued or carefully administered, being associated with stomachics or laxatives to mitigate its untoward effects.

Administration.—If the appetite be poor, iron should be administered in small doses (invariably after meals) or preceded by vegetable bitters. The tincture of the chloride and the stronger preparations should be freely diluted with water. The citrate of iron is a mild preparation well adapted for children and persons of delicate stomach.

Probably the salt richest in iron, yet of all the ferruginous preparations the most agreeable and least irritating, is the iron and potassium tartrate. The soluble ferric pyrophosphate is also a mild and pleasant preparation. The compound iron mixture possesses special advantages in the treatment of chlorosis and chronic diseases of the skin, while the solution of iron and ammonium acetate (Basham's mixture) is the best preparation in albuminuria—particularly that accompanying tubular nephritis—it being agreeable and well tolerated.

The best styptic is the ferric subsulphate or its solution.

Dialyzed iron, being agreeable to the taste, was formerly a popular remedy.

Some of the allied compounds above mentioned are very useful, agreeable, and efficient preparations of iron.

Mănganum—Măngani—Manganese.

This metal is a normal constituent of the body, existing in appreciable though minute quantities in the blood, bile, etc. From the fact of its presence in the blood, and because of the similarity of its chemical affinities to those of iron, theorists, rather than careful and practical observers, have advocated its use as a worthy and efficient substitute for the latter agent.

Its therapeutic uses as a restorative, or as an alternative or synergist to iron, are based more upon abstract deductions than upon clinical observation. Still, as its chemical character resembles that of iron—though the metal in its operation is often antagonistic to the latter—its salts are of sufficient therapeutic importance to merit brief mention here.

Măngani Diŏxidum—Măngani Diŏxidi—Manganese Dioxide. *U. S. P.*

(Black Oxide of Manganese.)

Origin.—Native, crude manganese dioxide, containing at least 66 per cent. of the pure dioxide.

Description and Properties.—A heavy, grayish-black, more or less gritty powder, without odor or taste; permanent in the air; insoluble in water or alcohol.

Dose.—5–40 grains (0.3–3.0 Gm.).

Măngani Sŭlphas—Măngani Sulphātis—Manganese Sulphate. *U. S. P.*

Origin.—Obtained by heating Manganese Dioxide with sufficiently strong Sulphuric Acid, evaporation, and crystallization.

Description and Properties.—Colorless or pale rose-colored, transparent, tetragonal prisms, odorless, and having a slightly bitter and astringent taste; slightly efflorescent in dry air. Soluble in 0.8 part of water and in 1 part of boiling water; insoluble in alcohol. Manganese sulphate should be kept in well-stoppered bottles.

Dose.—2–5 grains (0.1–0.3 Gm.).

(For *Potassium Permanganate* see section on *Antiseptics.*)

Antagonists and Incompatibles.—The salts of lead, silver, and mercury are incompatible with manganese.

Synergists.—Iron is theoretically synergistic, and the salts of zinc, copper, and silver are similar in their action on the nervous system.

Physiological Action.—*Externally and Locally.*—The two salts above mentioned have no important local action.

Internally.—In large doses these salts, especially the sulphate, irritate the gastro-intestinal tract, while excessive doses may even occasion gastro-enteritis. The sulphate acts as an emeto-cathartic and possesses cholagogue properties.

As is the case with many other drugs of this character, *small* doses may even promote the appetite and improve the digestive function. Large doses, or the continued administration of these preparations, affects the system more like zinc than iron, producing great depression, muscular weakness and waste, diminishing the pulse-beat, weakening the heart, and lowering arterial tension. There is, moreover, a tendency to fatty degeneration of the muscles and liver.

Therapeutics.—The manganese dioxide is highly beneficial in amenorrhea and dysmenorrhea, and has been used in the treatment of *gastralgia*, *pyrosis*, and *simple ulcer* of the *stomach*. Its action probably resembles that of bismuth, though it is a much less efficient remedy than the latter drug.

The sulphate is used occasionally as a cholagogue purgative in *malarial jaundice*, although why it should be preferred to many other and superior cholagogues it is difficult to understand. *Gouty dyspepsia* appears to have been much improved by the use of manganese. The association of iron and manganese makes a valuable combination in the treatment of *chlorosis* and many variations of *anemia*.

Phŏsphorus—Phŏsphori—Phosphorus. *U. S. P.*

Origin.—It exists, chiefly as phosphates, in many minerals and in all plants and animals. It is prepared by treating Calcined Bones with Sulphuric Acid, evaporation, and distillation.

Description and Properties.—A translucent, nearly colorless solid, of a waxy luster, having at ordinary temperatures about the consistence of beeswax. When kept for some time the surface becomes red and occasionally black. Phosphorus has a distinctive and disagreeable odor and taste (*tasting being allowable only in the form of extreme dilution*). When exposed to the air it emits white fumes, visible in the dark, and having an odor somewhat resembling that of garlic. Upon prolonged exposure to air it takes fire spontaneously.

Phosphorus is insoluble, or nearly so, in water, to which, however, it imparts its characteristic disagreeable odor and taste. It is soluble in 350 parts of absolute alcohol, in 80 parts of absolute ether, and in about 50 parts of any fatty oil. It is very soluble in chloroform or in carbon disulphide, the latter yielding a solution to be handled with the greatest care to prevent accident from combustion. The drug should be carefully kept under water, in strong, well-closed vessels, in a secure and moderately cool place protected from light.

Dose.—$\frac{1}{100}$–$\frac{1}{30}$ grain (0.0006–0.002 Gm.).

Official Preparations.

Oleum Phosphorātum—Ōlei Phosphorāti—Phosphorated Oil.—*Dose*, 1–5 minims (0.06–0.3 Cc.). A clear, yellowish liquid, having the odor of phosphorus and of ether, but not phosphorescent in the dark. It should be perfectly free from particles of undissolved phosphorus.

Pilulæ Phŏsphori—Pīlulas (acc.) **Phŏsphori—Pills of Phosphorus.**—*Dose*, one to two pills. Each pill contains $\frac{1}{100}$ grain (0.0006 Gm.) of phosphorus.

Spīritus Phŏsphori—Spīritus Phŏsphori—Spirit of Phosphorus (TINCTURE OF PHOSPHORUS).—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Elixir Phŏsphori—Elixir Phŏsphori—Elixir of Phosphorus.—*Dose*, $\frac{1}{2}$–2 fluidrachms (2.0–8.0 Cc.).

Antagonists and Incompatibles.—The principal chemical antidotes are hydrated magnesia, lime water, powdered charcoal, copper sulphate, and old acid turpentine.

Synergists.—Cod liver oil and the Restoratives generally aid the action of phosphorus. It is claimed that arsenic and sulphur are also synergistic.

Physiological Action.—*Externally and Locally.*—Applied to the skin, phosphorus causes local inflammation, ulceration, and possibly gangrene. The fumes may produce the most serious results—even maxillary necrosis where dental caries is present, as well as great irritation of the conjunctivæ and the respiratory mucous membrane. The graver systemic symptoms are confined to the conditions induced by toxic doses of the drug.

Internally.—Digestive System.—Taken into the stomach, no special effect is apparent as a result of small doses, save that the drug acts as a functional stimulant. Larger amounts have been held to impede digestion by impairing the action of the gastric juice upon albuminoid materials. Immoderate doses occasion

great irritation of the stomach and intestines, accompanied by abdominal distress, vomiting, and purging. Jaundice is a not infrequent result of ingestion, due to obstruction of the biliary ducts. Minute quantities stimulate the nutrition of the tissues, especially that of the osseous system.

Circulatory System.—The primary action is stimulating, the pulse rising and acquiring additional force, though not firmness. The facial capillaries are expanded, often congested; the cutaneous circulation becomes more rapid; and diaphoresis is produced. Under toxic doses the action of the heart is strongly depressed.

Nervous System.—In repairing the waste of tissue phosphorus acts upon the nervous system as a tonic, improving the nutrition of debilitated parts and restoring to normal conditions the functional activity of organs and tissues. Small or moderate doses act as stimulants to the entire nervous system, intellectual activity being promoted and the sexual appetite increased. Toxic effects include coma, and occasionally vertigo, with delirium, convulsions, insensibility, and collapse.

Respiratory System.—The deleterious action of the fumes of phosphorus is exemplified in their irritating effect upon the bronchopulmonary mucous membrane. Toxic symptoms are often accompanied by serious disturbances, respiratory failure being among the immediate causes of death.

Absorption and Elimination.—The *modus operandi* of absorption is a matter of some dispute. Probably a portion of the drug undergoes oxidation in the stomach, and the phosphoric acid formed, combining with the alkalies, enters the blood as phosphates. A part of the phosphorus is dissolved in the fats and oils present in the stomach, probably entering the circulation as elementary phosphorus.

The drug, having undergone oxidation in the system, is eliminated as ortho-phosphoric acid, chiefly by the urine, increasing the excretion of urinary phosphates. The liver shares in the excretory process.

Temperature.—Owing to capillary expansion, the superficial temperature is at first slightly raised, being subsequently diminished. Evaporation and radiation, arising from profuse diaphoresis, contribute to thermal reduction.

Eye.—In chronic poisoning from phosphorus hemorrhages and patches of degeneration in the retina are sometimes visible, the ophthalmoscopic picture resembling the retinitis of albuminuria.

Under medicinal doses no special effects upon the eye are reported, although, as has been stated, the vapor of phosphorus is highly irritant to the conjunctivæ.

Uterus.—The action of phosphorus tends to increase the menstrual flow.

Untoward Action.—Small doses produce in some individuals severe gastric disturbance, and in rare cases diarrhea, tenesmus, and jaundice. The fatty degeneration of the retinal capillaries mentioned above—such as results from chronic intoxication affecting workers in match-factories—is an untoward manifestation to be guarded against by every available means.

Poisoning.—The effects of a fatal dose of phosphorus are not immediate. After a lapse of several hours great weakness occurs, accompanied in a large majority of cases by vomiting. Abdominal pains follow, the symptoms becoming more acute, mucus and bile being present in the ejecta, which for a while retain the odor and luminosity of phosphorus. With the cessation of vomiting pain is abated, although it may extend over the entire abdominal region and even be attended with paroxysms.

The foregoing symptoms are accompanied by pronounced anorexia, thirst and fever, a thickly-coated or whitish tongue, burning in the throat, and often signs of collapse. The temperature at first reaches nearly the maximum possible without proving fatal, subsequently sinking below the normal. After thirty-six hours or more jaundice sets in. The urine is diminished, becoming charged with albumin and urates, and even bloody, containing among other ingredients biliary acids and coloring-matter. In fatal cases urea is almost wholly wanting. The stools may be normal, but the general condition is usually marked by diarrhea or constipation and flatulence. Hemorrhage often occurs, wounds bleeding profusely, and as the severity of the symptoms increases delirium ensues, or coma terminating in convulsions.

Serious nervous manifestations are frequently preceded by restlessness, insomnia, headache, and vertigo. In some delirious conditions wild, erotic states of the mind are the precursors of convulsive or comatose symptoms. Somnolence is not uncommon, with partial spasms and contraction or paresis of the voluntary muscles. *Post-mortem* examination shows that the liver, heart, kidneys, muscles, capillaries, and arterioles are implicated in the general effects of the poisoning, and are undergoing fatty degeneration.

Sometimes the preponderating influence of the poison affects

the bronchial and gastro-intestinal mucous membranes, or it may visit the nervous system or be manifested in the circulatory system. In cases of acute poisoning the duration of the malady varies greatly, death occurring at times within a few days, or, again, being deferred for a few weeks. As a rule, recovery is retarded, the elimination of the drug requiring time.

The symptoms of *chronic poisoning* are in some respects especially marked, inhalation of phosphorus-fumes frequently resulting in pronounced conditions of necrosis, particularly of the lower maxillary, although it has been maintained that this feature of the poisoning is contingent upon denuded surfaces of bone, disintegration or softening of tissues, caries of the teeth, or communicating wounds. Very rarely the palate and frontal bones are similarly attacked.

Treatment of Poisoning.—Emetics and purgatives are of the first necessity. Copper sulphate is the most efficient emetic as well as the best chemical antidote. Hydrated magnesia, charcoal, and lime water have been suggested, yet their action is tardy, and a more efficient antidote is desirable. Several chemical and physiological agents have been employed to counteract the effects of the drug, among them old acid (oxygenated) oil of turpentine and potassium permanganate in a $\frac{1}{3}$ per cent. solution, opium being used as a stimulant to the heart and the circulatory system.

As prophylactic measures for the protection of workmen against phosphor-necrosis masks covering mouth and nose have been found serviceable, as well as inhalation of the vapor of turpentine obtained by suspending a small bottle of the fluid about the neck. The teeth should be kept constantly in good condition, since caries favors the tendency to necrosis.

Therapeutics.—Phosphorus is not used externally, but internally it is a food, especially of the nervous and osseous systems, stimulating protoplasmic activity, although, according to Gubler, "phosphorus is a rapid stimulant, but it acts by causing waste, and not by increasing power; it impoverishes, and does not enrich; it momentarily galvanizes, as it were, the torpid functions, but is incapable of renewing a dilapidated constitution or even a nervous system exhausted by chronic disease."

Clinical experience has certainly demonstrated its utility as a nutrient tonic to the nervous and osseous tissues. In *neurasthenia* and *chronic nervous exhaustion* it is highly efficacious. *Paraplegia*, particularly when resulting from excessive venery, is usually benefited by this drug, while the cases of *locomotor ataxia* temporarily improved by phosphorus are numerous enough to deserve special

consideration. *Neuralgia*, particularly of the fifth nerve and accompanied by great debility, may be relieved by full doses administered every four hours.

It is claimed by competent observers that certain cases of *angina pectoris* have been completely relieved by phosphorus.

It has even been recommended in *epilepsy;* but its value here becomes more than doubtful when no mention of it is made by the best authorities on this disease.

In *paralysis* resulting from *cerebral hemorrhage* it has been found beneficial.

It has proved of great value in caries, delayed resolution of bone, *osteomalacia*, and *rhachitis*, and the drug is credited with the cure of *pernicious anemia*, though it is singular, if the drug possesses any real value in this disease, that the fact has been recognized by so few observers. Such able men as Fox and Broadbent praise its efficacy in *lymphadenoma*. The *insomnia of the aged* and the *wakefulness of cerebral anemia* and *exhaustion* usually yield to this remedy.

As to its aphrodisiac effects there is great difference of opinion, some physicians believing it to be a most powerful agent in relieving *functional impotence*, while others—among them so enthusiastic an advocate of phosphorus as Thompson—conclude that the drug is inefficient for this purpose unless given in larger doses than safety prescribes. The enthusiastic praise of its eulogists, however, as a remedy in impotence of a functional character is of so convincing a nature as to certainly justify an extended trial in this condition. Scarcely less is the testimony regarding its efficacy in *chronic psoriasis*, *lepra*, *lupus*, and *acne indurata*.

Administration.—Since many persons have a peculiar susceptibility to phosphorus, its administration should begin with small doses, and, should it be thought necessary to prolong the administration for an indefinite period, the tendency of the drug to produce general steatosis should not be forgotten.

The phosphorus pill is undoubtedly the best form in which to administer the drug, though it possesses the disadvantages of being insoluble in the intestinal fluids and of producing more or less irritation of the gastro-intestinal mucous membrane, though the latter effect is usually unnoticed under ordinary medicinal dosage on a full stomach. The liquid preparations of phosphorus are more unstable, tending to become rapidly inert by oxidation.

The spirit of phosphorus is sometimes given in cod-liver oil or the elixir of calisaya. Phosphorated oil and liquor phosphori (Thompson's solution) are highly recommended by competent authorities.

Călcii Hypophŏsphis—Călcii Hypophosphītis—Calcium Hypophosphite. *U. S. P.*

Origin.—Obtained by heating Phosphorus with Milk of Lime and exposing the mixture to the air.

Description and Properties.—Colorless, transparent, monoclinic prisms, or small, lustrous scales, or a white, crystalline powder; odorless, having a nauseous, bitter taste, and permanent in the air. Soluble in 6.8 parts of water and in 6 parts of boiling water; insoluble in alcohol.

Dose.—5–6 grains (0.3–0.4 Gm.).

Călcii Phŏsphas Præcipitātus—Călcii Phosphātis Præcipitāti—Precipitated Calcium Phosphate. *U. S. P.*

Origin.—Prepared by the action of Hydrochloric Acid and Water upon Bone-ash, the addition of Solution of Ammonia to render the mixture of an alkaline reaction, and washing and drying the precipitate.

Description and Properties.—A light, white, amorphous powder, odorless and tasteless, permanent in the air. Almost insoluble in cold water; partly decomposed by boiling water, which dissolves out an acid salt; almost insoluble in acetic acid, except when freshly precipitated; easily soluble in hydrochloric or nitric acid; insoluble in alcohol.

Dose.—10–30 grains (0.6–2.0 Gm.).

Sōdii Hypophŏsphis—Sōdii Hypophosphītis—Sodium Hypophosphite. *U. S. P.*

Origin.—Prepared by adding Sodium Carbonate to a solution of Calcium Hypophosphite and evaporating the filtrate.

Description and Properties.—Small, colorless, transparent, rectangular plates of a pearly lustre, or a white, granular powder, odorless, and having a bitterish-sweet, saline taste. Very deliquescent on exposure to moist air. Soluble in 1 part of water and in 30 parts of alcohol, also in 0.12 part of boiling water and in 1 part of boiling alcohol; slightly soluble in absolute alcohol; insoluble in ether. Sodium hypophosphite should be kept in well-stoppered bottles.

Dose.—5–10 grains (0.3–0.6 Gm.).

Potăssii Hypophŏsphis—Potăssii Hypophosphītis—Potassium Hypophosphite. *U. S. P.*

Origin.—Prepared in a similar manner to Calcium Hypophosphite, or by double decomposition of Calcium Hypophosphite and Potassium Carbonate.

Description and Properties.—White, opaque, hexagonal plates, or crystalline masses, or a granular powder, odorless, and having a pungent, saline taste; very deliquescent. Soluble in 0.6 part of water and in 7.3 parts of alcohol. Potassium hypophosphite should be kept in well-stoppered bottles.

Dose.—5–30 grains (0.3–2.0 Gm.).

Ăcidum Hypophosphorōsum Dilūtum—Ăcidi Hypophosphorōsi Dilūti—Diluted Hypophosphorous Acid. *U. S. P.*

Origin.—Prepared by decomposing Potassium Hypophosphite by Sulphuric Acid, filtering, and evaporating to a syrupy consistence. It contains 10 per cent. by weight of absolute hypophosphorous acid.

Description and Properties.—A colorless liquid, without odor, and having an acid taste. Specific gravity about 1.046. Miscible in all proportions with water.

Dose.—It is never used as a therapeutic agent by itself, but in the syrup of the hypophosphites.

Sўrupus Hypophosphītum—Sўrupi Hypophosphītum—Syrup of Hypophosphites.

Formula: Calcium Hypophosphite, 45; Sodium Hypophosphite, 15; Potassium Hypophosphite, 15; Diluted Hypophosphorous Acid, 2; Spirit of Lemon, 5; Sugar, 500; sufficient Water to make 1000.

Dose.—1–2 fluidrachms (4.0–8.0 Cc.).

Sўrupus Hypophosphītum cum Fĕrro—Sўrupi Hypophosphītum cum Fĕrro—Syrup of Hypophosphites with Iron.

Formula: Ferrous Lactate, 10; Potassium Citrate, 10; Syrup of the Hypophosphites, to 1000.

Dose.—1–2 fluidrachms (4.0–8.0 Cc.).

Zĭnci Phŏsphidum—Zĭnci Phŏsphidi—Zinc Phosphide. *U. S. P.*

Origin.—Prepared from Vapor of Phosphorus in a current of Dry Hydrogen over heated Zinc, after all atmospheric air has been expelled.

Description and Properties.—A gritty powder of a dark-gray color, or crystalline fragments of a dark, metallic luster, and having a faint odor and taste of phosphorus. In contact with air it slowly emits phosphorous vapor. Insoluble in water or alcohol. Zinc phosphide should be kept in small glass-stoppered bottles.

Dose.—$\frac{1}{16}$–$\frac{1}{3}$ grain (0.004–0.02 Gm.).

Antagonists and Incompatibles.—The sodium and potassium hypophosphites are incompatible with the soluble salts of mercury and silver, and the soluble phosphates and carbonates are incompatible with calcium hypophosphite. Zinc phosphide is decomposed by mineral acids.

Synergists.—Phosphorus, cod liver oil, and the Restoratives generally.

Physiological Action.—Although not possessing the active and poisonous properties of phosphorus, the HYPOPHOSPHITES are similar in their effect to small doses of phosphorus—*i. e.* in stimulating and regenerating the nervous system and those tissues which contain phosphorus and lime.

The CALCIUM PHOSPHATE possesses no action superior to that of the hypophosphite, and its virtues are chiefly those of the hypophosphite.

The phosphate is soluble to a slight extent in lactic and hydrochloric acids, so that when taken by the stomach a portion diffuses into the blood.

The ZINC PHOSPHIDE is more active, and resembles more closely the action of phosphorus, and in too large doses it irritates the stomach in the same manner as uncombined phosphorus.

Therapeutics.—*Externally and Locally.*—The CALCIUM PHOSPHATE, combined with a little free phosphoric acid, has been recommended by Doubenski in the treatment of *tuberculous ulcerations.* "*Cold abscesses* and *fistulous tracts* were treated by packing with gauze soaked with a solution of 5 parts to 100."

Internally.—The HYPOPHOSPHITES may be employed for the same conditions as those in which phosphorus is used. In *chlorosis, anæmia, scrofula,* and *tuberculosis* they have been highly recommended. In the author's opinion, in the cachexiæ mentioned the

benefit derived from their use is slight compared with that of cod liver oil and the hygienic influences rendered serviceable in these conditions.

The praise bestowed upon calcium phosphate consists largely of assertions rather than evidence: if it possesses any therapeutic value, it is chiefly that of the hypophosphite.

The ZINC PHOSPHIDE has medicinal virtues greatly superior to those of the preparations above mentioned. In nervous disorders dependent upon defective nutrition it is equal, if not superior, to phosphorus, and it may be employed for any condition in which the latter drug is useful.

Administration.—The zinc phosphide is best given in pill form. The hypophosphites and calcium phosphate may be given in capsules, though the syrup of the hypophosphites is usually preferred. It is a question whether the sugar which the syrup contains may not tend to induce or aggravate the gastric fermentation so often present in cases requiring the use of a reconstituent.

Cinchōna—Cinchōnæ—Cinchona. *U. S. P.*

Origin.—The bark of *Cinchona Calisaya* Weddell, *Cinchona officinalis* L., and of their hybrids and those of other species of *Cinchona*, yielding, when assayed by the process given in the U. S. Pharmacopœia, "not less than 5 per cent. of total alkaloids and at least 2.5 per cent. of quinine." The genus Cinchona as at present constituted consists of from thirty-one to thirty-six species, all of which are native to South America. The habitat of the tree follows the eastern slope of the Andes, beginning in Bolivia and extending through Peru. From about 2° south latitude in Ecuador it occupies also the eastern slope of the Western Cordilleras, until by two narrow belts it enters the highlands of New Granada, whence it spreads northeast and northward into Venezuela, reaching the vicinity of Caracas and the Caribbean Sea.

The climate in which the most valuable species are found is, according to Karsten (1858), characterized by a rainy season lasting for nine months, heavy rains falling principally during the night, alternating with sunshine and fog during the day. During the remaining three months of the year the nightly temperature frequently sinks below freezing-point, in the day-time, however, reaching 25° C. (77° F.), producing dense fogs.

The Cinchonas are evergreen trees or shrubs, the most valuable

species attaining a height of from 40 to 80 feet (12 to 24 M.). They are not met with in the valleys, but are found at altitudes varying from 330 feet (100 M.) to 11,500 feet (3500 M.). According to Weddell, the most valuable species grow at an altitude of 5300 to 7900 feet (1600 to 2400 M.). All the species are found in the primeval forests, either singly or in collections of a few specimens. The tree is cultivated in British Sikkim, Ceylon, Java, and Jamaica.

Description and Properties.—In quills or in curved pieces, varying in length, and usually $\frac{1}{12}$ or $\frac{1}{8}$ inch (2 or 3 Mm.), or sometimes $\frac{1}{5}$ inch (5 Mm.), thick; the outer surface covered with a gray or brownish-gray cork, usually slightly wrinkled, marked with transverse and also intersecting longitudinal fissures (*C. Calisaya*), and sometimes with scattered warts and slight longitudinal ridges; inner surface light cinnamon-brown, very highly striate; fracture of the outer layer short and granular, finely fibrous in the inner layer; powder light- or yellowish-brown; odor slight, somewhat aromatic; taste bitter and somewhat astringent.

Cinchōna Rūbra—Cinchōnæ Rūbræ—Red Cinchona. *U. S. P.*

Origin.—The bark of *Cinchona succirubra* Pavon, containing not less than 5 per cent. of its peculiar alkaloids.

Description and Properties.—In quills or in curved pieces, varying in length, and from $\frac{1}{12}$ to $\frac{1}{6}$ or $\frac{1}{5}$ inch (2 to 4 or 5 Mm.) thick; the outer surface covered with a grayish-brown cork, more or less rough from warts and longitudinal warty ridges, and few, mostly short, transverse fissures; inner surface more or less deep reddish-brown and distinctly striate; fracture short-fibrous in the inner layer; powder reddish brown; odor slight; taste bitter and astringent.

Among the various alkaloids found in cinchona the following are the most important: *Quinine*, *quinidine*, *cinchonine*, and *cinchonidine*, the medicinal value of the bark depending almost exclusively upon the alkaloid *quinine*.

Other less important ingredients are kinic and kinovic acids, kinovin, cinchotannic acid, cinchona-red, and a minute quantity of a butyraceous, volatile oil. The ash amounts to between 1 and 2 per cent., consisting chiefly of the carbonates of calcium and potassium.

Dose of powdered cinchona, 15–60 grains (1.0–4.0 Gm.).

Official Preparations of Cinchona.

Extrăctum Cinchōnæ—Extrăcti Cinchōnæ—Extract of Cinchona.—*Dose*, 5–30 grains (0.3–2.0 Gm.).

Extrăctum Cinchōnæ Flūidum—Extrăcti Cinchōnæ Flūidi—Fluid Extract of Cinchona.—*Dose*, 10–60 minims (0.6–4.0 Cc.).

Infūsum Cinchōnæ—Infūsi Cinchōnæ—Infusion of Cinchona (6 per cent.).—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Tinctūra Cinchōnæ—Tinctūræ Cinchōnæ—Tincture of Cinchona (20 per cent.).—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Official Preparation of Cinchona Rubra.

Tinctūra Cinchōnæ Compŏsita—Tinctūræ Cinchōnæ Compŏsitæ—Compound Tincture of Cinchona (10 per cent., with Bitter Orange Peel 8 per cent., and Serpentaria 2 per cent.).—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Official Alkaloids and Salts.

Cinchonidīnæ Sūlphas—Cinchonidīnæ Sulphātis—Cinchonidine Sulphate.—*Description and Properties.*—White, silky, acicular crystals, without odor and having a very bitter taste; slightly efflorescent on exposure to air. Soluble in 70 parts of water and in 66 parts of alcohol.

Dose.—10–30 grains (0.6–2.0 Gm.).

Cinchonīna—Cinchonīnæ—Cinchonine.—*Description and Properties.*—White lustrous prisms or needles, without odor, at first almost tasteless, but soon developing a bitter after-taste; permanent in the air; soluble in 3760 parts of water and in 116 parts of alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Cinchonīnæ Sūlphas—Cinchonīnæ Sulphātis—Cinchonine Sulphate.—*Description and Properties.*—Hard, white, lustrous, prismatic crystals, without odor and of a very bitter taste; permanent in the air; soluble in 66 parts of water and in 10 parts of alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Quinidīnæ Sūlphas—Quinidīnæ Sulphātis—Quinidine Sulphate.—*Description and Properties.*—White silky needles, odorless, and of a very bitter taste; permanent in the air; soluble in 100 parts of water and in 8 parts of alcohol. It should be kept in well-stoppered bottles, in a dark place.

Dose.—5–30 grains (0.3–2.0 Gm.).

Quinīna—Quinīnæ—Quinine.—*Description and Properties.*—A white, flaky, amorphous or crystalline powder, odorless, and having a very bitter taste; permanent in the air; soluble in 1670 parts of water and in 6 parts of alcohol. Quinine should be kept in well-stoppered bottles, in a dark place.

Dose.—1–60 grains (0.06–4.0 Gm.).

Quinīnæ Bisūlphas—Quinīnæ Bisulphātis—Quinine Bisulphate.—*Description and Properties.*—Colorless, transparent, or whitish orthorhombic crystals or small needles; odorless and having a very bitter taste; efflorescent on exposure to the air. Soluble in 10 parts of water and in 32 parts of alcohol. It should be kept in well-stoppered bottles, in a dark place.

Dose.—1–15 grains (0.06–1.0 Gm.).

Quinīnæ Hydrobrōmas—Quinīnæ Hydrobromātis—Quinine Hydrobromate.—*Description and Properties.*—White, light, silky needles; odorless and of a very

bitter taste. The salt is liable to lose water on exposure to warm or dry air. Soluble in 54 parts of water and in 0.6 part of alcohol. It should be kept in well-stoppered bottles, in a dark place.

Dose.—1–20 grains (0.06–1.3 Gm.).

Quinīnæ Hydrochlōras—Quinīnæ Hydrochlorātis—Quinine Hydrochlorate.—*Description and Properties.*—White, silky, light, and fine needle-shaped crystals, odorless, and having a very bitter taste. The salt is liable to lose water on exposure to warm air. Soluble in 34 parts of water and in 3 parts of alcohol. Quinine hydrochlorate should be kept in well-stoppered bottles, in a dark place.

Dose.—1–15 grains (0.06–1.0 Gm.).

Quinīnæ Sŭlphas—Quinīnæ Sulphātis—Quinine Sulphate.—*Description and Properties.*—White, silky, light, and fine needle-shaped crystals, fragile and somewhat flexible, making a very light and easily compressible mass, lusterless from superficial efflorescence after being for some time exposed to the air; odorless and having a persistent, very bitter taste. The salt is liable to lose water on exposure to warm air, to absorb moisture in damp air, and to become colored by exposure to light. Soluble in 740 parts of water and in 65 parts of alcohol, also in 40 parts of glycerin and in about 680 parts of chloroform, and freely soluble in dilute acids. It should be kept in well-stoppered bottles, in a dark place.

Dose.—1–60 grains (0.06–4.0 Gm.).

Quinīnæ Valeriānas—Quinīnæ Valerianātis—Quinine Valerianate.—*Description and Properties.*—White or nearly white, pearly, lustrous, triclinic crystals, having a slight odor of valerianic acid, and a bitter taste; permanent in the air; soluble in 100 parts of water and in 5 parts of alcohol. It should be kept in well-stoppered bottles, in a cool place.

Dose.—1–20 grains (0.06–1.3 Gm.).

Unofficial Alkaloids and Salts.

Chinoidīnum—Chinoidīni—Chinoidine.—*Origin.*—Obtained from the mother-liquor in the preparation of quinine sulphate, cinchonine, and the other alkaloids of cinchona.

Description and Properties.—Cylindrical rolls or masses, of a more or less deep-brown or black color and a resin-like appearance. It has but a slight taste, being faintly bitter on mastication. Almost insoluble in water; freely soluble in alcohol.

Dose.—3–30 grains (0.2–2.0 Gm.).

Cinchonidīnæ Salĭcylas—Cinchonidīnæ Salicylātis—Cinchonidine Salicylate.—*Dose*, 2–10 grains (0.12–0.6 Gm.).

Cinchonīna Iodosŭlphas—Cinchonīnæ Iodosulphātis—Cinchonine Iodosulphate (ANTISEPTOL) (50 per cent. of iodine).—*Description and Properties.*—A light powder of a reddish-brown color; insoluble in water, but soluble in alcohol. Used principally as a substitute for iodoform.

Chĭnolin—Chĭnolin—Chinolin (QUINOLIN).—*Origin.*—Prepared from Cinchonine or Quinine by distillation, or obtained synthetically.

Description and Properties.—A colorless liquid, with an aromatic, pungent odor; slightly soluble in water, freely soluble in alcohol.

Dose.—3–10 minims (0.18–0.6 Cc.).

Chĭnolin Tărtras—Chĭnolin Tartrātis—Chinolin Tartrate.—Soluble in 70 or 80 parts of water. *Dose*, 5–15 grains (0.3–1.0 Gm.).

Quinētum—Quinēti—Quinetum.—A mixture of the alkaloids precipitated by an alkali. *Dose*, 1–60 grains (0.06–4.0 Gm.).

Quinīnæ Hydrochlōras Carbamidāta—Quinīnæ Hydrochlorātis Carbamidātæ.—Double salt of Quinine and Urea. Soluble in water. *Dose*, 1–10 grains (0.06–0.6 Gm.). Usually employed hypodermically.

Antagonists and Incompatibles.—Agents promoting waste—such as the salts of mercury, iodine, copper, zinc, and lead—are therapeutically antagonistic to cinchona. The cerebral effects of quinine are antagonized by morphine, while atropine opposes its action upon the nervous and circulatory systems, as well as its antipyretic powers.

The incompatibles are free tannic acid, alkalies and alkaline earths, and iodine. Fowler's solution is incompatible with infusion and decoction of cinchona.

Synergists.—The Restoratives and all agents promoting constructive metamorphosis. The antipyretic action of quinine is enhanced by the antipyretics, salicylic acid, and some of the antiseptics. Its antiperiodic action is aided by arsenic, eucalyptus, carbolic acid, and creasote.

The name Cinchona given to Peruvian bark was accorded in honor of the countess of Chinchon, cured of tertian fever by the use of the drug, as early as the seventeenth century, the Spanish conquerors of the country having discerned the curative properties of the plant which scientific investigation has rendered invaluable as a therapeutic agent. The native Indians had long been acquainted with its medicinal virtue, and but for the inquisitorial bigotry of the age the beneficiary of its potency, upon her return to Spain, would have introduced it into Europe. Such, however, was the antagonism aroused among an over-zealous clergy, and so great the force of professional rivalry, that everywhere the new discovery encountered opposition, one religious body formally spurning it as the invention of unenlightened savages, although the countess was not deterred from employing it among the peasantry dwelling upon her estates (Markham).

About the middle of the seventeenth century a large quantity of the bark received from America reawakened discussion, and finally a council of Jesuits held at Rome approved a distribution of the drug—called therefrom "Jesuits' bark." It quickly found its way to other parts of the Continent and to England; yet still the opposition to its use was pronounced, and it was only when an English quack doctor succeeded in effecting cures among persons

of rank by an employment of the drug that its services became general in malarial and typhoid fevers, as well as in various other diseases.

The discovery of the active principles of cinchona, crudely established by Duncan in 1803, was perfected by Pelletier and Caventou in 1820 by the preparations of quinine and cinchonine. In 1833 quinidine became partially known, being completely isolated as an active principle in 1852, quinine and cinchonine having been employed since 1820–21.

Until the researches of Marchiafava, Celli, Laveran, Golgi, and others had disclosed the true etiology of malaria, quinine was used empirically in malarial diseases, its precise action being unknown. Its efficacy is now ascertained to be due to its power of destroying the plasmodia of malaria. In addition to this action, which renders the drug of the greatest value in malarial diseases, quinine possesses many other important properties, which are here considered.

Physiological Action.—*Externally and Locally.*—The drug is a potent antiseptic, preventing putrefaction and fermentation by its destructive influence upon fungi and infusoria, a solution of 1 : 250 being sufficient for this purpose, while 1 : 500 is fatal to certain micro-organisms, and even so weak a solution as 1 : 1000 suffices to destroy some infusoria.

Upon the unbroken skin it has little effect, other than to produce occasionally a slight roughening of the surface. To raw surfaces, however, and to mucous membranes it is irritant.

Internally.—Digestive System.—Its action resembles that of vegetable bitters, augmenting the secretions from the salivary and gastro-intestinal glands, stimulating peristalsis, and increasing the blood-supply to the stomach. Under moderate doses, therefore, the appetite and digestion are improved. Large dosage disturbs digestion, occasioning nausea, with, possibly, vomiting and diarrhea. The acidity of the stomach is said to be increased by quinine sulphate.

Circulatory System.—Small doses increase the force and frequency of the heart's action, excessive doses slowing and weakening it, and, frequently in children, causing an intermittent pulse. Toxic doses paralyze the heart, arresting it in diastole. It is uncertain whether or not these effects are due to an exclusive action on the cardiac muscle. It is evident, though, that small doses elevate and large doses depress arterial tension.

Quinine in a remarkable manner affects the constituents of the blood. The ameboid movements of the white blood-corpuscles are arrested, preventing their migration through the capillary walls in inflammation, while their number is diminished by full doses of the drug both in health and in inflammatory conditions. The red corpuscles are relatively increased in number, at least in proportion to the white corpuscles, the size of the former being diminished in febrile conditions.

Quinine retards or impairs all the oxidizing powers of the body, and materially lessens the oxygen-carrying capacity of the red corpuscles. This is shown in the diminished metabolism of the body.

Nervous System.—Small doses stimulate the cerebrum. Large doses occasion cerebral congestion, with a sensation of dizziness, fulness in the head, and other symptoms described at length under "Cinchonism."

The reflex function of the spinal cord is reduced, and under toxic doses ultimately abolished, owing to stimulation of Setschenow's inhibitory center, and later to direct depression of the spinal cord and nerves (Wood). In frogs the sensory nerves are first excited and subsequently paralyzed, through the influence of the drug upon the peripheral endings. The muscles are uninfluenced, though when applied directly to muscular fiber the drug acts as an irritant, producing muscular contractions.

Respiratory System.—Quinine exerts but little influence upon the respiration, small doses slightly increasing and large doses depressing the respiratory movements; death being due to respiratory paralysis, at least in the lower animals.

Absorption and Elimination.—The drug is quite rapidly absorbed from the alimentary canal. While its presence may be detected in the urine within fifteen minutes after the ingestion of a full dose, many hours, or even days, may elapse before the drug is finally excreted.

Much of the drug undergoes a change in the system, especially in the liver, yet it may be detected in the urine as quinine and various isomeric modifications of it. While chiefly eliminated by the kidneys, it may escape from the system by other channels, having been found in the milk, sweat, saliva, tears, bile, and in dropsical effusions.

The excretion of uric acid, urea, and other nitrogenous material is considerably diminished under the use of quinine.

Temperature.—In health the temperature is unaffected by qui-

nine, but in febrile conditions, particularly in malarial fever, the drug acts as a powerful antipyretic. Yet the drug cannot be classed as a true antipyretic, since it has not been shown that it has any action on the heat-center. It is a matter of clinical observation that intermittent, typhoid, and one form of puerperal fever are the only diseases which readily yield to the antipyretic influence of quinine, the temperature in such maladies as erysipelas, pneumonia, pleurisy, etc. being comparatively unaffected even by large dosage, seeming to prove that the drug is an antipyretic only when it destroys or renders inert the infective agent producing the fever.

Eye.—There have been recorded several cases of amblyopia and of quinine amaurosis, with transitory blindness, color-blindness, wide dilatation of pupils—irresponsive to light, but responding to accommodation effort—pallor of the optic disks, with extreme diminution of both retinal veins and arteries and contraction of the visual field.

Quinine amaurosis, however, is probably very rare, but a limited number of cases being recorded, although Rogers believes that "incomplete ocular cinchonism" is of quite frequent occurrence.

Uterus.—After the inception of labor quinine seems frequently to stimulate the uterine contractions. It also increases a scanty menstrual flow. There appears to be no authoritative evidence that quinine is an abortifacient.

Untoward Action.—Besides the symptoms of cinchonism from which some persons suffer after the ingestion of a small dose, there are often occasioned various eruptions of the skin, often accompanied by marked pruritus, the eruption produced by the drug at times strongly resembling scarlatina.

Peculiar disturbances of vision and impaired hearing not infrequently attend the administration of quinine. There have been recorded cases of renal and vesical irritation, varying in intensity, following the use of the drug. The administration of the salts of quinine in pill form is often followed by gastro-intestinal catarrh. The drug has also been known to occasion epistaxis and hemoptysis.

Poisoning.—Excessive doses of quinine produce a series of symptoms collectively termed *cinchonism.* They are—a feeling of fulness in the head, ringing or buzzing in the ears, varying degrees of deafness, headache, with possibly delirium, disturbances of vision, vertigo, and muscular weakness. Should the dose be lethal, there may be marked cardiac and respiratory failure, and collapse.

Treatment of Poisoning.—Potassium bromide and hydrobromic acid are the best agents to relieve the symptoms of cinchonism, full doses of the latter given with quinine being said to prevent untoward results.

Should the dose be sufficient to depress the heart and respiration in a marked degree, cardiac and respiratory stimulants would be indicated.

Therapeutics.—*Externally and Locally.*—Powdered cinchona bark is an ingredient of many tooth-powders. Quinine also enters into the composition of many "hair tonics," and is highly recommended by some physicians in the treatment of *alopecia.*

The drug has been employed with varying success in many diseases of the nose and throat, such as *hay fever, whooping cough, ozena, tonsillitis,* etc.

Ledetsch has highly recommended quinine bisulphate, 1 part to 100 parts of water and glycerin, as an injection in *gonorrhea.* The drug has been used with tincture of ferric chloride as a paint to prevent the spread of *erysipelas.* A 2 per cent. solution has proved an efficient remedy in *cystitis,* effectually preventing the decomposition of the urine.

Internally.—Undoubtedly the principal use of quinine is in the treatment of *malarial diseases.* When we realize that quinine in 1 part to 20,000 is sometimes destructive of the plasmodium malariæ, it is readily understood why the drug should be so efficient as an antimalarial remedy.

Quinine is one of the most powerful antiperiodics, being of more or less value in many diseased conditions characterized by periodical exacerbations. All forms of *malarial fever* usually yield to the proper use of quinine. It seems to be equally efficient as a prophylactic.

Many periodical affections due occasionally to malarial organisms are peculiarly amenable to this drug, among these disorders being various *neuralgias, headache, asthma, hay fever, chorea, jaundice, diarrhea, dysentery,* etc.

Quinine is a potent antiphlogistic, being very efficient in checking inflammation and suppuration. It is particularly beneficial in cases of prolonged suppuration, such as *pulmonary phthisis, fistulous discharges, septicemia, pyemia, puerperal fever,* etc. It favorably influences the formative stages of acute inflammations, as in the beginning of *endocarditis, pneumonia, pleurisy,* etc.

As a tonic or restorative during the course of febrile diseases,

as well as in convalescence, quinine is highly efficient. Its action upon the gastro-intestinal tract renders it valuable in many forms of *dyspepsia*, especially the atonic variety. In these cases, where anemia is present, the drug may be advantageously combined with iron and nux vomica.

Quinine is but little used now as a pure antipyretic, being of value in this respect, as previously stated, only when it destroys the infective cause of the fever. Its antipyretic influence is consequently more marked in *intermittent fever*. It is of value also in *typhoid*, although now seldom employed in this disease.

The remedy has proved efficient in some cases of *chorea* and *whooping cough*. It is of decided value in the *yeasty vomiting* produced by the sarcina ventriculi, and equally beneficial in *impetigo*; while *acne* and *ecthyma*, when occasioned by reduced vitality and impaired nutrition, are greatly benefited by its internal use.

Quinine is serviceable in stimulating the *uterine contractions during labor* and increasing the menstrual discharge in *amenorrhea*.

Contraindications.—The drug is contraindicated in acute inflammations of the genito-urinary and gastro-intestinal tracts, in acute or subacute inflammations of the middle ear, and in meningitis and cerebritis. It should not be given to infants suffering from eczema, nor to persons having a marked idiosyncrasy against the drug.

Administration.—Because of its intensely bitter and disagreeable taste quinine should not be given in solution. It may be suspended in syrup of yerba santa or in the aromatic elixir of liquorice, which disguises the taste quite effectually, and for children is preferable, as a method of administration, to capsules or pills. In the case of adults the drug should be given in gelatin capsules or in the form of gelatin- or sugar-coated pills.

The tannate of quinine is comparatively tasteless, and may be incorporated with chocolate in the form of lozenges, thus being readily taken by children.

The drug may be also administered in a suppository by the rectum or incorporated in lard and rubbed into the skin, preferably in the axillæ and the inner side of the thighs or over the abdomen. It has been employed to some extent hypodermically, the quinine hydrobromate and hydrochlorate being the salts preferred for this purpose. Injections should be made in the buttocks, and very slowly administered, since this method of administration depresses the heart to a considerable degree.

Occasionally in the treatment of malaria Warburg's tincture, containing numerous aromatics, is more efficient than quinine.

In obstinate malarial affections aromatics and spices greatly enhance the effect of quinine, capsicum making one of the best adjuvants. The portal circulation is stimulated, rendering the absorption of the drug more rapid and its effects more lasting.

As to the time and method of administration in malarial diseases, the student is referred to any standard work on the Practice of Medicine.

The various tinctures and elixirs of cinchona are used extensively; when employed as stomachics they should be given before meals.

Quinine is best given on an empty stomach or after the active process of digestion is completed.

ANIMAL EXTRACTS (ORGANOTHERAPY).

THE striking fact that various excretions and tissues of the living organism, when administered under certain conditions, possess a peculiar therapeutic value is now well ascertained. The theory, although generally considered an innovation in therapeusis, has long been the subject of studious attention, yet only in recent years has the practical application of organotherapy claimed professional recognition and the nature and operation of its curative properties acquired unprecedented significance. Extracts derived from almost every portion of the human system, together with many animal secretions, have been prepared, and their efficacy tested by searching experiment. It was reserved for the noted investigator Brown-Séquard and his associates to inaugurate, as late as 1889, the system of organotherapeusis as known to-day and promulgate the theory resulting in the now established medicinal potency of glandular extracts.

Among the earliest and most original essays prompted by the new procedure was Brown-Séquard's hypodermic injection of an extract from the recent testicles of mammals, in the treatment of *senile debility*. It should be noted, in passing, that, curiously enough, as there is no new thing under the sun, this special employment of organic extract for the relief of morbid conditions finds an analogue in a custom of very ancient origin, the high authority of Pliny the historian attesting that the Grecian and Roman de-

bauchés were wont to consume the testicles of asses to restore their dissipated energies.

While it must be admitted that the benefits derived from the administration of testicular juice have failed to realize the ardent anticipations of its earlier advocates, we may cheerfully concede that the experimental impetus imparted by it to clinical and therapeutic investigation has added considerably to our scientific knowledge in the realm of medicine and gone far to alleviate the ills of suffering humanity. As a nutrient restorative *spermini hydrochloras* has been found to be an efficacious remedy, abundant evidence showing that the functional activity of deteriorating organs of the animal economy are perceptibly improved by its use, the nervous system responding favorably to the influence of the new agent.

To one interested in the allied studies of obstetrics and gynecology, the novel method is of comparatively little interest, save so far as it relates to scientific investigation. The action of ovarian and mammary extracts, however, is of more than passing importance. Within the past few years these preparations have been used to greater or less extent in the treatment of various conditions, with considerable success, particularly in the amelioration of symptoms attending the menopause.

The most rational and successful application of organotherapy, perhaps, was that of Murray in 1891, who proposed the subcutaneous injection of a *thyroid extract* in the treatment of *myxedema*, many cases of which have improved, while others have been definitely cured by the adoption of the remedy. The preparations in this case have included the ingestion of the dry powder, the injection of a glycerin extract, and the raw or partially cooked gland administered as food. The testimony of competent authorities amply attests the efficacy of the agent, which now receives almost universal acceptance.

"Thyroid extracts and desiccated thyroids," says Gould, "produce marked physiological effects upon the nervous and circulatory systems, as indicated by headache, dizziness, pains in other portions of the body, great weakness; and by flushing of the face and rapidity of the heart's action. Some of these symptoms usually occur when the daily dose corresponds to $1\frac{1}{2}$ or 2 entire thyroid glands of the sheep. Desiccated glands appear quite as active as the liquid extracts, and are more stable." The author adds that internal administration is no less efficient than hypodermic injection.

Prof. Wood lucidly summarizes our present knowledge of the physiological action and therapeutic value of this preparation: "In hypertrophy of cicatricial tissue resembling keloid, possibly true keloid, thyroid extract has caused absorption of the hypertrophied and cicatricial tissue. It has been used with success in simple goiter; in the goiter of Switzerland, before calcareous degeneration has taken place, it will bring about destruction and absorption of the overgrown tissue. In excessive obesity with tendency to weakness and anemia, in which exercise and diet fail, thyroid extract should be tried. It is sometimes useful in melancholia, but how it acts we do not know. When thyroid extract is used freely in continuing doses it sometimes produces a series of phenomena constituting so-called 'thyroidism.' The most important of the symptoms are loss of weight, shortness of breath, and a weak and rapid pulse. In all cases in which the extract is being used freely and continuously, but especially in those cases in which the symptoms are not those of myxedema, the patient should be weighed every two weeks, and any undue loss of weight or disturbance of circulation or respiration should be the immediate signal for the withdrawal of the remedy or a great reduction of the dose. The thyroid extract has been largely used in exophthalmic goiter; but here, I am sure, it does harm. The cause of the symptoms in exophthalmic goiter is undoubtedly the excessive development of the thyroid secretion."

Gould observes that "the use of thyroid in myxedema rests on a firm scientific foundation," adding that "it has been tried empirically in many diseases." The same author, speaking of thyreoidin, says: "Baumann claims to have isolated the active principle of the thyroid gland. It is an organic compound containing a large proportion of iodin and ½ per cent. of phosphorus. Experiments conducted by Dr. Ross are said to show that this new body has the same effect on the human organism as the thyroid gland itself. Several substances have been obtained by different investigators from the thyroid gland—thyreoproteid, thyreoantitoxin, and thyreoidin have been supposed to embody the active principle, but they have not found favor."

With regard to the therapy of the various glandular extracts much has been written, and concerning the practical efficacy of certain preparations contending opinions prevail. The list of conditions in the treatment of which they have proved more or less favorable is a long one, including cancer, chorea, nervous conditions,

such as neurasthenia, sexual atony, several forms of hysteria, together with systemic disorders, such as profound anemia, chlorosis, or chloro-anemia, associated with dysmenorrhea, osteomalacia, while, besides myxedema and exophthalmic goiter, fibroid tumors of the uterus, and inoperable carcinomata of the breast, uterus, and vagina have been materially improved, if we may believe the reports of trustworthy observers. Perhaps the latest application of thyroid is its use in a case of cerebral neoplasm, cited in the *Journal of the American Medical Association*, May 6, 1899:

"Loving, Columbus, Ohio, has used thyroid extract in a man, 18 years of age, a student, of healthy parentage, but who, in 1896, without assignable cause, began to suffer from constant headache with severe exacerbations. Within six months he found his vision affected, soon to such an extent as obliged him to suspend his studies, and, later, to interfere materially with movement from place to place. With the exception of an attack of typhoid fever in his fifteenth year, his history is uneventful and his habits correct. Examination by competent oculists disclosed no lesion in either eye, though the vision was about equally affected in both. At a consultation between the oculists, a neurologist, and a surgeon, it was decided that the patient was suffering from an intracranial neoplasm, nature and precise location not defined—suspicion of syphilitic origin. He was treated with mercurials and iodid of potassium with no beneficial result, and after a rest of some weeks treatment was resumed with negative results; tonics used with no results. Thyroid extract was prescribed and continued with a few short intermissions for several months, when improvement soon became manifest, and the patient has now so far recovered as to be able to read and write with ease and comfort. He reported the case before the recent session of the Association of American Physicians, May 2–4."

The following résumé[1] is of interest:

"With the treatment of myxedema, cretinism, Basedow's disease, lipomatosis universalis, cachexia strumipriva, and insanity, it would seem as if the use of thyroid had reached its limitations. The successful administrations and beneficial results obtained in some of the above diseases, however, have stimulated many observers and experimenters to make a wider trial of this form of medication, with the result that hardly a week passes by without an attempt being recorded to extend its field of usefulness. Thus we

[1] *Medical Record*, Dec. 31, 1898.

find Hertoghe advocating the use of thyroid as a galactagogue, and his good results have been corroborated by Stawell. Apart from this, the *Klinische therapeutische Wochenschrift*, No. 24, 1898, mentions spastic torticollis, tetany, acromegaly, Parkinson's disease combined with struma and scleroderma, as conditions in which the administration of thyroid gland has proved beneficial. Delace reports the case of a woman suffering from hemophilia, with bleeding gums, excessive menstruation, and purpura, in whom thyroid effected a complete cure. In gynecology good results have been reported from the administration of the extract in fibroid tumors, the growth having decreased in size and the general health improved. In dermatological practice the remedy has found its principal application in psoriasis and ichthyosis, although premature grayness has responded to its use.

"The dosage, method of administration, and danger-signals are no less important than the indications for its use. The hypodermic administration of the liquid extract and the grafting of the fresh gland have long fallen into disuse, and the tendency of the present day is to administer the powder or to give tablets or capsules prepared from the desiccated fresh gland. The dose varies with the individual, and for this reason it is advisable to begin with small doses, which should be gradually increased until the desired effect is produced. Beginning with one or two grains a day, as much as fifteen grains may be administered, the prescriber always being on the *qui vive* for poisonous symptoms. During the course of administration especial attention should be given to the respiratory and cardiac apparatus, and at the first appearance of rapid pulse, embarrassed respiration, rise of temperature, vertigo, or gastric disturbance, its use should be abandoned.

"Thyroid was the pioneer of the animal extracts, and thus far may be said to hold the first rank. Its field of application has been so varied that it is to be hoped that physiologists and pathologists will study its *modus operandi* more thoroughly, so that its administration in all conditions may be based upon strictly scientific grounds."

Improvement has been noted in several cases of malignant *syphilis*, Menzies considering that thyroid acts as a powerful skin-tonic and a useful adjuvant to mercury and potassium iodide in the treatment of this disease.

The favorable results often attending the partial employment of animal agents in diseases of corresponding organs, and especially

the noteworthy benefits derived from the application of the thyroid treatment in myxedema, have suggested the preparation of many extracts of varying efficacy. Among these are—

Suprarenal Extract.—An interesting pamphlet "On the Blood-pressure-raising Constituent of the Suprarenal Capsule," by Drs. John Abel and Albert C. Crawford, of Johns Hopkins University, throws important light upon the subject. The following abstract will be of interest:

It has been clearly shown that a minute quantity of an aqueous extract of the medullary substance suffices to raise the blood-pressure greatly above normal. Applied to the eye (Bates), it was found to exert a marked vaso-constricting action, and this authority states, as a result of two years' use of the extract, "that within the limits of its sphere of activity there is absolutely no other substance which can take its place." Certain experiments indicate that the aqueous extract is a powerful poison when injected directly into the circulation, leading, possibly, to fatal results, and it is still a question whether the various actions ascribed to the gland are due to one and the same substance. Brunner, following Krukenberg, maintains that pyrocatechin is present in the suprarenal gland, though Fränkel refutes this statement. Vulpian, Virchow, Schäfer, and others have held various opinions regarding the blood-pressure-raising constituent of the gland, the chemical character of which remains unknown. The isolation of a definite chemical compound remained to be accomplished, a task in which Drs. Abel and Crawford have suceeeded, obtaining a constituent of the gland, approximately pure, by means of its benzozol derivative.

The active principle obtained possesses great physiological activity. Chemically it is probably a pyridin base or an alkaloid. It does not yield pyrocatechin by boiling with acids. It exists in the form of a sulphate; yet a pigment can be split off without destroying its power to raise the blood-pressure. Another basis-substance with a coniine-like odor always accompanies the benzoate of the blood-pressure-raising principle.

"As thus far isolated, the sulphate is a hygroscopic, straw-colored residue, which tends to crystallize on standing over sulphuric acid, agglomerates of small crystals forming on the edge of the bowl and the entire residue taking on a semi-crystalline appearance." As shown by repeated experiments, this final product possesses all the characteristics of an extremely active substance, promptly raising the blood-pressure, constricting the vessels of an inflamed eye, and,

when injected into the dorsal lymph-sac of the frog, acting like a narcotic or cerebro-spinal poison. The authors of the analysis consider it quite possible that a little pyrocatechin may be present in the gland, although not yet discovered. They insist, however, that the blood-raising constituent is not a pyrocatechin derivative.

B. Moore, in the *Journal of Physiology*, suggests that the active physiological principle of the suprarenal gland may be a pyridin derivative.

The suprarenal extract should be freshly prepared, its active principle being weakened by heat and preservation. It is the most powerful astringent known, a single drop of a 1 per cent. solution instilled into the eye resulting in a whitening of the conjunctiva and lids in from two seconds to forty minutes. It is useful in all forms of inflammation of the eye, whether traumatic, infectious, or proceeding from constitutional diseases, such as rheumatism, syphilis, or tuberculosis. The pupil is not contracted by it, and tolerance is not established by its use. It possesses neither antiseptic nor anesthetic properties, the rapid cures attending its employment being entirely due to its wonderfully astringent influence.

In suppurative otitis and dry catarrh the extract is often valuable in relieving congestion. By it tinnitus is permanently relieved. It lessens the congestion of turbinated bodies immediately, often benefiting catarrhal affections when cocaine and other astringents fail. It reduces the congestion of an inflamed eye sufficiently to permit cocaine anesthesia. It has been found efficacious in relieving various strictures, as of the nasal duct, the urethra, and the esophagus.

Velich found that the extract occasions local anemia when applied to the skin, not only where there is a lesion, but also where the cuticle is unbroken. It has been used to whiten an eczematous patch and to prevent vesiculation, while compresses saturated with the extract have dispelled hyperemia in cases of vertigo. Dr. Douglas Stanley found that in one case of pernicious anemia the freshly prepared aqueous extract produced a marked increase in the number of red corpuscles. It is valuable in Addison's disease (Osler), and is a tonic to the heart-muscles (Oliver and Schäfer), "the tension being enormously increased by intravenous injections," though its action is less marked in subcutaneous use, and is uncertain when administered *per os*. It is much more powerful than either digitalis or ergot.

Dr. George W. Crary used the extract of the suprarenal capsule with decided success in a case of exophthalmic goiter.

In short, "As a pure astringent in all inflammations, as a hematic, and as a tonic—I might also say food—to all muscle fibers, especially the heart, no therapeutic agent has been employed which can compare with the extract of the suprarenal gland."[1] The doctor prepares the aqueous extract as follows: "This can be done without much trouble. I mix ten grains of dried gland with two drachms of water, and filter. The filtrate is a 1 per cent. solution of the extract."

Nuclein.—In 1894, Professor V. Vaughan, of the University of Michigan, read a paper before the Illinois State Medical Association, giving the results of numerous experiments made by himself and Dr. McClintock with nuclein.

Nuclein is a complex proteid body, characterized by its large percentage of phosphorus. It is that constituent of a cell by virtue of which the histologic unit grows, develops, and reproduces itself; it is the function of the nuclein to utilize the pabulum within its reach; it is by the action of their nuclein that cells of various organs and organisms possess and manifest their individual characteristics. It is sometimes called chromatin on account of the readiness with which it absorbs and holds coloring-agents. The chromatic difference in the nucleins of various cells is an aid to their identification under the microscope.

The phosphorus exists in the form of nucleinic acid; so far as is known, this acid is the same in all cells, yet the basic part differs in various nucleins. Most of the experiments of Vaughan and McClintock, as well as those of nearly all others, have been made with the yeast nuclein; that cell is particularly rich in nucleinic acid, easily obtained free from contamination.

When administered hypodermatically or orally, nuclein increases the number of leukocytes in about three hours. The amount of increase varies with the subject; it may be slight or it may be threefold; it occurs principally in the polynuclear cells. Metschnikoff has shown that these cells are the most active of the phagocytes.

Hans Buchner has demonstrated that the blood-serum, freed from corpuscular elements, is bactericidal. This bactericidal potency is due to nuclein, found free in the blood and probably secreted by the leukocytes. Hahn of Munich has made experiments with serum upon the staphylococcus pyogenes aureus and the bacillus coli communis, showing that the administration of yeast nuclein

[1] Dr. W. H. Bates, in *New York Med. Jour.*, March 16, 1896, and *New York Med. Rec.*, Oct. 8, 1898.

increased this germicidal power several fold. The effects of nuclein pass away in about forty-eight hours.

Nuclein is of great value in conditions of infection where the symptoms are due to general invasion of the bacteria. Favorable results are obtained in simple *anemias*. It is found on the market in a 5 per cent. solution, dose 1 to 2 drachms. It should be given on an empty stomach. Vaughan reports that in *tuberculosis* the effect of moderate injections has been to lower the temperature, without untoward manifestations. *Indolent ulcer* has yielded completely to a similar treatment.

It is also stated upon high authority that the remedy is useful in "all forms of *anemia*, in chronic and recurrent *malaria*, in *digestive disorders*, and in acute and chronic *pulmonary affections*" (Aulde), the nuclein adopted being obtained from the thyroid and thymus glands. The latter author suggests the use of nuclein in the treatment of *typhoid*, in which disease the activity of leucocytosis is defective.

Bone-marrow has proved efficacious in *anemia* (Dickson, Frazer), and has also been employed by Filleau in *tuberculosis*.

DIVISION II.—ALTERATIVES.

THESE drugs are unnatural to the system, though acting specifically, and in some unknown way, against certain diseases or morbid conditions. They are given with a view to influencing the course of the disease itself, not for their effect upon the symptoms alone. If administered for any length of time, there is danger of poisoning, because of the characteristic action of these medicines, which differs essentially from their remedial influence.

When used as alteratives they do not produce or relieve symptoms, except by renewal of health or by removing either the pathological condition or the disease. Whenever, therefore, these drugs produce symptoms when used specifically, it is a sign that they are contraindicated, or have been given for too long a time, or in too large doses. As they are unnatural, and consequently more or less poisonous to the system, their administration should be accompanied by restoratives to lessen their tendency to untoward manifestations and systemic depression.

Mercury, being perhaps the most typical alterative, will be first considered.

Hydrărgyrum—Hydrărgyri—Mercury. *U. S. P.*

(QUICKSILVER.)

Origin.—The knowledge of this drug antedates the Christian era. It is found in Spain, Austria, Peru, and China, but is obtained principally from New Almaden, California. It occurs to some extent in the metallic state in the form of minute or large globules; also in combination with oxygen, chlorine, selenium, etc.; but the principal ore from which it is extracted is cinnabar.

Description and Properties.—A shining, silver-white metal, without odor or taste. It is liquid at the ordinary temperature, and easily divisible into spherical globules; but when cooled to —39.38° C. (—38.88° F.), it forms a ductile, malleable mass. Specific gravity, 13.5584 at 15° C. (59° F.).

Insoluble in the ordinary solvents, also in concentrated hydrochloric acid, and, at common temperatures, in sulphuric acid, but dissolving in the latter when boiled with it, and readily and completely soluble in nitric acid. Mercury should be kept in strong, well-stoppered bottles.

Dose.—Mercury is seldom given internally except in the modified form of blue pill.

Hydrărgyrum Ammoniātum—Hydrărgyri Ammoniāti—Ammoniated Mercury. *U. S. P.*

Origin.—Prepared by mixing solutions of Ammonia and Corrosive Mercuric Chloride. Filter and wash the precipitated ammoniated mercury.

Description and Properties.—White, pulverulent pieces, or white, amorphous powder, without odor, and having an earthy, and afterward styptic and metallic taste. Permanent in the air. Almost insoluble in water or in alcohol. It should be kept in well-stoppered bottles, protected from the light. Used externally.

Official Preparation.

Unguĕntum Hydrărgyri Ammoniāti—Unguĕnti Hydrărgyri Ammoniāti—Ointment of Ammoniated Mercury.—Formula: Ammoniated Mercury, 10; Benzoinated Lard, 90 parts. For external use.

Hydrărgyrum cum Crēta—Hydrărgyri cum Crēta—Mercury with Chalk. *U. S. P.*

Origin.—Obtained by trituration of Mercury, Prepared Chalk, Clarified Honey, and Water.

Description and Properties.—A light gray, rather damp powder, free from grittiness, without odor, and having a slightly sweetish taste. It contains 38 per cent. of mercury. This preparation should be kept in well-stoppered bottles, protected from light.

Dose.—3–10 grains (0.18–0.6 Gm.).

Măssa Hydrărgyri—Măssæ Hydrărgyri—Mass of Mercury. *U. S. P.*

(Pilula Hydrargyri—Blue Mass—Blue Pill.)

Composed of Mercury, Glycyrrhiza, Althæa, Glycerin, and Honey of Rose.

Dose.—½–10 grains (0.03–0.6 Gm.).

Unguĕntum Hydrărgyri—Unguĕnti Hydrărgyri—Mercurial Ointment. *U. S. P.*

(Blue Ointment.)

Composition: Mercury, Lard, Suet, and Oleate of Mercury. Used externally.

Emplāstrum Ammoniaci cum Hydrārgyro—Emplāstrum (acc.) Ammoniāci cum Hydrargyro—Ammoniac Plaster with Mercury. *U. S. P.*

Composition: Ammoniac, Mercury, Oleate of Mercury, Diluted Acetic Acid, and Lead Plaster. Used externally.

Emplāstrum Hydrārgyri—Emplāstri Hydrārgyri—Mercurial Plaster. *U. S. P.*

Composition: Mercury, Oleate of Mercury, and Lead Plaster. Used externally.

Hydrārgyri Chlōridum Corrosīvum — Hydrārgyri Chlōridi Corrosīvi—Corrosive Mercuric Chloride. *U. S. P.*

(Corrosive Chloride of Mercury—Corrosive Sublimate.)

Origin.—Prepared by heating a mixture of Mercuric Sulphate, Sodium Chlorate, and Manganese Dioxide. The corrosive chloride sublimes and is condensed.

Description and Properties.—Heavy, colorless, rhombic crystals or crystalline masses; odorless and having an acrid and persistent metallic taste. Permanent in the air. Soluble in 16 parts of water, in 3 parts of alcohol, in 2 parts of boiling water, in 1.2 parts of boiling alcohol, in 4 parts of ether, and in about 14 parts of glycerin. It should be kept in well-stoppered bottles.

Dose.—$\frac{1}{64}$–$\frac{1}{8}$ grain (0.001–0.008 Gm.).

Hydrārgyri Chlōridum Mīte—Hydrārgyri Chlōridi Mītis—Mild Mercurous Chloride. *U. S. P.*

(Calomel—Mild Chloride of Mercury.)

Origin.—Obtained by triturating Mercuric Sulphate, Mercury, Sodium Chloride, and boiling Distilled Water. Sublime, and wash the sublimed calomel with boiling distilled water.

Description and Properties.—A white, impalpable powder, becoming yellowish-white on being triturated with strong pressure. It is odorless and tasteless, and permanent in the air. Insoluble in water, alcohol, or ether, and also in cold, diluted acids. When strongly heated it is wholly volatilized, without melting. Calomel should be kept in dark, amber-colored bottles.

Dose.—$\frac{1}{12}$–10 grains (0.002–0.6 Gm.).

Calomel enters into the following

Official Preparations.

Pĭlulæ Antimōnii Compŏsitæ—**Pĭlulas** (acc.) **Antimōnii Compŏsitas**—Compound Pills of Antimony.—*Dose*, 1 or 2 pills.

Pĭlulæ Cathărticæ Compŏsitæ—**Pĭlulas** (acc.) **Cathărticas Compŏsitas**—Compound Cathartic Pills.—*Dose*, 1 to 3 pills.

Hydrărgyri Cyănidum—Hydrărgyri Cyănidi—Mercuric Cyanide. *U. S. P.*

Origin.—It may be obtained by boiling pure Ferrocyanide of Iron with Mercuric Oxide; the mercuric cyanide, entering into solution, is separated by filtration, evaporization, and crystallization from diluted alcohol.

Description and Properties.—Colorless or white prismatic crystals; odorless, and having a bitter, metallic taste (*the salt is exceedingly poisonous*), becoming dark-colored on exposure to light. Soluble in 12.8 parts of water and in 15 parts of alcohol.

Dose.—$\frac{1}{100}$–$\frac{1}{16}$ grain (0.0006–0.004 Gm.).

Hydrărgyri Iōdidum Flāvum—Hydrărgyri Iōdidi Flāvi—Yellow Mercurous Iodide. *U. S. P.*

(Hydrargyri Iodidum Viride—Protiodide of Mercury—Yellow (or Green) Iodide of Mercury.)

Origin.—Prepared by mixing solutions of Potassium Iodide and Mercurous Nitrate with Nitric Acid and Distilled Water. The precipitate is washed and dried.

Description and Properties.—A bright yellow amorphous powder, odorless and tasteless. By exposure to light it becomes darker in proportion as it undergoes decomposition into metallic mercury and mercuric iodide. Almost insoluble in water, and wholly insoluble in alcohol or ether. It should be kept in dark, amber-colored vials, with the least possible exposure to light.

Dose.—$\frac{1}{6}$–$\frac{1}{2}$ grain (0.01–0.03 Gm.).

Hydrărgyri Iōdidum Rūbrum—Hydrărgyri Iōdidi Rūbri—Red Mercuric Iodide. *U. S. P.*

(Biniodide of Mercury—Red Iodide of Mercury.)

Origin.—Prepared by mixing solutions of Corrosive Mercuric Chloride and Potassium Iodide; filter, and dry the precipitated red iodide.

Description and Properties.—A scarlet-red, amorphous powder, odorless and tasteless; permanent in the air. Almost insoluble

in water, but soluble in 130 parts of alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose.—$\frac{1}{32}$–$\frac{1}{16}$ grain (0.002–0.004 Gm.).

This drug enters into the

Official Preparation.

Līquor Ărseni et Hydrărgyri Iōdidi—Liquŏris Ărseni et Hydrărgyri Iōdidi—Solution of Arsenic and Mercuric Iodide.—(Described under *Arsenic.*)—*Dose,* **5 minims** (0.3 Cc.), gradually increased.

Hydrărgyri Ŏxidum Flāvum—Hydrărgyri Ŏxidi Flāvi—Yellow Mercuric Oxide. *U. S. P.*

Origin.—Prepared by precipitating a solution of Corrosive Mercuric Chloride with Soda.

Description and Properties.—A light orange-yellow, amorphous, heavy, impalpable powder; odorless, and having a somewhat metallic taste. Permanent in the air, but turning darker on exposure to light. Almost insoluble in water or in alcohol. It should be kept in well-stoppered bottles, protected from light. Not used internally.

Official Preparation.

Unguĕntum Hydrărgyri Ŏxidi Flāvi—Unguĕnti Hydrărgyri Ŏxidi Flāvi—Ointment of Yellow Mercuric Oxide.—Formula: Yellow Mercuric Oxide, 10; Ointment, 90 parts. Used externally.

Hydrărgyri Ŏxidum Rūbrum—Hydrărgyri Ŏxidi Rūbri—Red Mercuric Oxide. *U. S. P.*

(Red Precipitate.)

Origin.—Prepared by dissolving Mercury in Diluted Nitric Acid. Evaporate to dryness. Triturate the mercuric nitrate thus formed with mercury and heat.

Description and Properties.—Heavy, orange-red crystalline scales, or a crystalline powder, becoming yellower the finer it is divided; odorless, and having a somewhat metallic taste; permanent in the air. Almost insoluble in water and in alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose.—$\frac{1}{64}$–$\frac{1}{10}$ grain (0.001–0.006 Gm.).

Official Preparation.

Unguĕntum Hydrărgyri Ŏxidi Rūbri—Unguĕnti Hydrărgyri Ŏxidi Rūbri—Ointment of Red Mercuric Oxide.—Formula: Red Mercuric Oxide, 10; Castor Oil, 5; Ointment, 85 parts. Used externally.

Hydrărgyri Subsŭlphas Flāvus—Hydrărgyri Subsulphātis Flāvi—Yellow Mercuric Subsulphate. *U. S. P.*

(Basic Mercuric Sulphate—Turpeth Mineral.)

Origin.—Obtained by dissolving Mercury in Sulphuric and Nitric Acids. Add a sufficient quantity of Water. Decant and dry the residue.

Description and Properties.—A heavy, lemon-yellow powder, odorless and almost tasteless; permanent in the air. Soluble in about 2000 parts of water. Insoluble in alcohol. It should be kept in well-stoppered bottles, protected from the light.

Dose.—$\frac{1}{4}$–3 grains (0.015–0.18 Gm.).

Līquor Hydrărgyri Nitrātis—Liquōris Hydrărgyri Nitrātis—Solution of Mercuric Nitrate. *U. S. P.*

A liquid containing about 60 per cent. of Mercuric Nitrate, together with about 11 per cent. of free Nitric Acid.

Description and Properties.—A clear, nearly colorless, heavy liquid, having a faint odor of nitric acid and a strongly acid reaction. The product should be kept in glass-stoppered bottles.

Used externally as a caustic.

Unguĕntum Hydrărgyri Nitrātis—Unguĕnti Hydrărgyri Nitrātis—Ointment of Mercuric Nitrate. *U. S. P.*

(Citrine Ointment.)

Formula: Mercury, 70; Nitric Acid, 157; Lard Oil, 760 parts. Used externally.

Unofficial Preparations.

Hydrărgyri Salĭcylas—Hydrărgyri Salicylātis—Mercurous Salicylate.—*Dose of Mercurous Salicylate,* $\frac{1}{8}$–$\frac{1}{4}$ grain (0.008–0.015 Gm.).—*Dose of Mercuric Salicylate,* $\frac{1}{16}$–$\frac{1}{8}$ grain (0.004–0.008 Gm.).

Hydrărgyri Formamidātum—Hydrărgyri Formamidāti—Formamidate of Mercury.—*Dose* for *hypodermic* use, $\frac{1}{12}$–$\frac{1}{4}$ grain (0.005–0.01 Gm.).

Hydrărgyri Tănnas—Hydrărgyri Tannātis—Mercurous Tannate.—*Dose,* $\frac{1}{2}$–1 grain (0.03–0.06 Gm.).

Lōtio Flāva—Lotiōnis Flāvæ—Yellow Wash.—Corrosive Sublimate, 25 grains (1.5 Gm.), 6 ounces (473.17 Cc.). For external use.

Nigræ—Black Wash.—Calomel, 64 grains (4.15 Gm.), [illegible]7 Cc.). For external use.

Dose, $\frac{1}{8}$ grain (0.01 Gm.), hypodermically.

Antagonists and Incompatibles.—Mercury with chalk is incompatible with acids and acidulous salts. Calomel is incompatible with alkalies, alkaline earths, alkaline carbonates, iron, lead, copper, iodine, bromides, soaps, sulphydrates, and nitrohydrochloric acid, as well as hydrochloric acid, potassium, ammonium, and sodium chloride.

Corrosive sublimate is incompatible with alkalies and their carbonates, soap, lime water, tartar emetic, the iodides of potassium and sodium, acetate of lead, silver nitrate, the sulphides, albuminous liquids (as milk, etc.), many vegetable infusions, and compound syrup of sarsaparilla.

In general, metallic preparations of mercury are incompatible with iodine and the chlorides.

Synergists.—Potassium iodide enhances the antisyphilitic action of mercury. Depressants—such as antimony and alkalies—increase the physiological activity of mercury and its preparations.

Tonic and resin-bearing purgatives—such as aloes, rhubarb, and podophyllum—aid the cathartic action of some of the mercurial preparations.

Physiological Action.—*Externally and Locally.*—Most of the preparations applied to the skin are antiparasitic and antiseptic, corrosive mercuric chloride being one of the most important antiseptics and universal germicides known.

Some of the mercurials are powerful irritants, the nitrate being an active caustic. The mercurous salts, even, possess slightly stimulating properties.

Metallic mercury and its salts are readily absorbed with the aid of friction, at times producing a slight irritation resulting from their stimulating properties. Absorption may also take place from local application in the form of a fine vapor.

The introduction of the drug into the system through the medium of the skin is attended with all the symptoms of mercurial poisoning. The local actions of the various preparations differ somewhat, yet they agree in certain physiological effects produced after absorption of the drug.

A common feature of mercurial application is a slight, peculiar fetor in the mouth, accompanied by soreness of the teeth, swelling of the gums, and an increase of saliva, ptyalism being a marked symptom of mercurial disturbance. A disagreeable metallic taste is seldom absent. These symptoms assume a serious phase if the

application be continued, stomatitis and other graver conditions ensuing.

Internally.—Digestive System.—Small doses have little untoward effect; they may even prove tonic. Large doses act unfavorably upon the gastro-intestinal mucous membrane, causing diarrhea and possibly more serious derangement. As purgatives the mercurial preparations act by augmenting the secretions of the intestinal glands; at the same time the pancreatic secretions are increased and there is marked activity of the absorbent system. The principal action is on the duodenum, hastening evacuation of the bile and preventing its reabsorption. While promoting excretion of bile, they act the reverse as to its secretion. This is particularly true of calomel, which actually diminishes that secretion, though it is alleged that the corrosive mercuric chloride is a direct cholagogue, stimulating to some extent the hepatic secretory apparatus.

Circulatory System.—Corrosive sublimate exerts a decided influence upon the heart, its toxic effect tending to diminish cardiac action. The remaining preparations of mercury appear to be less active in this respect. The physical action of the drug upon the corpuscular constituents of the blood has been well ascertained, anemia, reduced cohesion, and final dissolution having been observed. It is to be noted that under prolonged or over-dosage the blood becomes impoverished, its ozonizing function is impaired, and the fibrin loses its coagulability. But when administered in minute doses the mercuric corrosive chloride acts as a tonic to the blood, increasing the number of red corpuscles and the body-weight.

Should "tonic doses" be continued for too long a period, there would be increased weight, owing to too great stimulation of the lymphatic system.

Nervous System.—The full effects of mercury and its preparations upon the nervous system are best seen when toxic doses are given. The effects are considered *in extenso* under the head of "Poisoning." In small doses the tonic effects are present.

Respiratory System.—The general tendency of mercury, in those who have been subject to prolonged dosage, is to depress the circulation, rendering the breathing labored and debilitated, a sense of respiratory constriction being present.

Absorption and Elimination.—When a preparation of mercury is taken internally it is converted in the stomach into a double chloride of sodium and mercury. This substance, uniting with the

albuminous juices, is soluble in an excess of albumin and sodium chloride, and, readily diffusing into the blood, is converted into, and exists in that fluid as, the oxyalbuminate of mercury.

The absorption of this drug is gradual, yet, notwithstanding every secretion of the body contributes to its general expulsion from the system, its cumulative action is a well-established fact. Elimination occurs chiefly by the urine, the saliva, bile, sweat, milk, and feces. Even the semen shares in the process. Single doses may be eliminated in twenty-four hours, but the drug has been detected in the liver a year after the discontinuance of prolonged treatment.

Mercury has been found in serum and in pus from ulcers.

Calomel possesses marked diuretic action, greatly increasing the amount of urine.

Temperature.—Save in a secondary manner, temperature is seldom affected. From over-stimulation or irritation the drug may produce local inflammatory conditions or even febrile symptoms.

Eye.—Himly mentions that *amaurosis mercurialis* occurs in workers in mercury, while Galezowski reports an example of *optic atrophy*, and Square cites a case of *optic neuritis*, due to the toxic action of mercurial salts.

Untoward Action.—Many affections of the skin manifest themselves after the exhibition of mercury, *erythema* and *eczema* (eczema mercuriale) frequently occurring after either the ingestion or the external application of mercurial preparations.

The author recalls one patient in whom $\frac{1}{4}$ grain (0.016 Gm.) of calomel excited an exanthematous eruption over the entire body, some edema of the face, together with fever and angina of the fauces. At another time similar symptoms were produced in this patient by immersing the hands in a 1 : 2000 solution of corrosive sublimate.

In certain persons having an idiosyncrasy regarding this drug extreme salivation and stomatitis may be induced by the internal use or the external application of mercurial preparations in medicinal quantities.

Medicinal doses may produce, in susceptible persons, marked disturbances of nutrition, sensation, and motion to such a degree as to suggest poisoning.

Poisoning.—Although mercury in a metallic state is comparatively innocuous, its vapor is capable of producing violent and dangerous symptoms. All the salts are active poisons, especially

that known as corrosive sublimate. The symptoms following toxic doses of this preparation resemble those occasioned by arsenic. The salt, however, being more readily soluble, produces proportionately more speedy and pronounced effects. They are, briefly, a strong, metallic taste in the mouth, frequent and bloody evacuations, tenesmus, severe abdominal pains, vomiting, and labored respiration. There may be suppression of urine, syncope, and perhaps insensibility and convulsions.

One of the most obstinate features of mercurial poisoning is ptyalism or salivation. This condition is first manifested by tenderness of the gums and teeth. The gums are inflamed and covered by a white, sticky substance, and bleed at the slightest provocation. The breath is very offensive. The teeth become loose, and may drop out. Necrosis of the maxillary bones may appear, and extensive ulcerations of the gums and cheeks frequently occur. Accompanying these manifestations is an enormous increase in the amount of saliva secreted, which in some instances literally runs from the mouth night and day, often depriving the patient of sleep. Not infrequently a swelling of the lymphatic glands is also observed. Articulation and deglutition are interfered with from swelling of the tongue and ulceration of the gums, cheeks, palate, and tonsils. These symptoms, together with the fever, anorexia, muscular weakness, and headache which are constant accompaniments of ptyalism, render the condition of the patient very serious and tormenting.

Chronic mercurial poisoning, or *mercurial cachexia*, is the effect produced by prolonged exposure to the fumes of mercury. The blood becomes thin and poor, with degeneration of the corpuscles. The person becomes emaciated, the heart is weak, and the whole muscular system impaired. Respiration is rapid and shallow, and the mental faculties are affected. Loss of memory, irritability of temper, melancholia, and, in rare cases, mania, may ensue. All the special senses are affected. Deafness, dimness of vision, impaired taste and sensation, as well as intestinal derangement, edema, articular pains, and generally disordered secretions, manifest themselves.

Mercurial cachexia frequently produces muscular tremors, usually beginning in the upper extremities with gradual extension. Even paralysis of groups of muscles is often the result of chronic mercurial poisoning.

Treatment of Poisoning.—In acute poisoning from corrosive sub-

limate or other active salt of mercury it is necessary to evacuate the stomach as quickly as possible, and give white of eggs freely. The after-treatment is similar to that of other corrosive poisons—the use of demulcents and opiates.

For salivation, potassium chlorate probably occupies the first place as a prophylactic and curative agent. It is employed as a gargle and mouth-wash in a 2 to 3 per cent. solution. An astringent wash is frequently necessary. Such drugs as tannin, myrrh, krameria, etc. may be used for this purpose. Where there is extensive ulceration of the mouth disinfectant and antiseptic solutions will be found desirable.

In cases of chronic mercurial poisoning it is of primary importance to remove all traces of the drug from the system by means of iodides, the dosage being limited in quantity, but continued for some time.

Elimination of the poison from the tissues may be accomplished in various ways—the potassium iodide administered alternately with magnesium sulphate, laxatives, sulphur baths, and sulphur given internally. A change of air, liberal and nutritious diet, and tonics are also necessary.

Therapeutics.—*Externally and Locally.*—As a germicide, antiseptic, and antiparasitic the preparations of mercury are extremely valuable, the corrosive chloride of mercury being extensively employed as an antiseptic in general surgery in strengths of from 1 : 1000 to 1 : 10,000.

In *diseases of the skin* due to animal or vegetable parasites there are no drugs so valuable as certain preparations of mercury, the ointment of ammoniated mercury being highly prized.

CALOMEL in the form of an ointment, 5 to 20 grains (0.3–1.25 Gm.) to 1 ounce (32.0 Gm.) is an efficient remedy in *eczema.*

Indolent *venereal ulcers* are much improved by dusting them with calomel, while the early inflammatory conditions of these sores may be greatly benefited by the use of black wash.

Many diseases of the *eye*, *ear*, *nose*, and *throat* yield to various preparations of mercury. The ointment of the YELLOW OXIDE OF MERCURY is particularly adapted to *phlyctenular ophthalmia*, *pannus*, *keratitis*, *chronic blepharitis marginalis*, etc.

Inunction with MERCURIAL OINTMENT or with OLEATE OF MERCURY is excellent for the constitutional treatment of the first and second stages of *syphilis.* These two preparations are of great value in *subacute synovitis*, *pelvic cellulitis*, and *syphilitic orchitis* and *epididymitis.*

The OINTMENT OF THE RED IODIDE OF MERCURY has a reputation as an efficient remedy in *goiter* and *syphilitic enlargement of the spleen*, as well as in *pachymeningitis*.

The SOLUTION OF NITRATE OF MERCURY is an active and reliable caustic in the treatment of *phagedenic ulcerations* and *venereal ulcerations of the os uteri*.

The use of mercurials is usually attended with excellent results in promoting resolution of fibrous induration resulting from chronic inflammation.

Internally.—The principal use of mercury is undoubtedly as an antisyphilitic. Mercury is an antidote against *constitutional syphilis*, being particularly efficient in the secondary stage. Many methods of mercurializing a patient have been adopted, mention of which will be made under "Administration." It is perhaps unnecessary to caution the therapeutist to make an accurate and positive diagnosis of syphilis before instituting the mercurial treatment, as otherwise the consequences may be disastrous.

Mercury has been used in all stages of the disease, though, possibly from ignorance of its proper use, its employment has met with less favorable results in the primary than in the secondary form, while a careful study of syphilology leads one to believe that in tertiary syphilis it is inferior to the iodides, if not, indeed, actually contraindicated.

The medical uses of mercurial preparations in disorders of the alimentary tract are very numerous.

Chronic dysentery will frequently yield to $\frac{1}{100}$ to $\frac{1}{60}$ grain (0.0006–0.001 Gm.) of CORROSIVE CHLORIDE OF MERCURY and *diarrheas* of children—particularly those characterized by pale, offensive stools—together with *ileo-colitis* of infants, are greatly benefited by small doses of CALOMEL or GRAY POWDER, which will also allay *obstinate vomiting*.

As a purgative in *bilious attacks*, *hepatic congestion*, and *cirrhosis* CALOMEL is an extremely valuable drug. Its action as a purgative will be more fully described under "Cathartics."

This drug is also a remarkably efficient diuretic.

The internal use of mercury is of great value in all *non-suppurative inflammations*, as *cirrhotic conditions in the glandular structures*, or in *scleroses in the nervous system*, such as *hepatic cirrhosis*, *chronic interstitial nephritis*, *locomotor ataxia*, *chronic endarteritis*, *chronic affections of the lungs and pleura*, etc.

Many acute febrile and inflammatory conditions, such as *menin-*

gitis, *pericarditis*, and *hepatitis*, are sometimes benefited by the internal administration of calomel, though in acute inflammations the chief value of the drug, whether specific or non-specific, is manifest in *iritis* and in *acute bronchitis* which shows a tendency to persist.

Calomel given early in from 10- to 20-grain (0.6–1.0 Gm.) doses in cases of *pneumonia* is esteemed very highly by some authorities.

Calomel and opium have been used and recommended by some physicians in the treatment of *Asiatic cholera*.

The internal use of BICHLORIDE OF MERCURY is unquestionably of much value in the treatment of *diphtheria*, and the subsulphate of mercury is an old and very effective emetic in *membranous laryngitis*.

The author has often successfully treated *marasmus* of *infants* with bichloride of mercury administered three times a day in doses of from $\frac{1}{120}$ to $\frac{1}{100}$ grain (0.0005–0.0006 Gm.).

Contraindications.—Mercury is usually contraindicated in *tuberculosis* and in persons of *strumous diathesis*; and, while it is of value when judiciously employed in *chronic interstitial nephritis*, it must nevertheless be given cautiously, and if the excretion of urine is diminished by its use, the drug should be immediately discontinued.

Children, though not easily salivated, are very susceptible to other poisonous actions of calomel.

Ordinarily, *acute asthenic diarrhœa* and *dysentery* in adults would contraindicate the use of mercurials.

Administration.—Mercury is introduced into the system by—

1. *Inunction.*—The portion of the body upon which the preparation is to be applied should first be thoroughly washed with soap and warm water, and the ointment well rubbed in with the palm of the hand. The best localities for application are the inner sides of the thighs, the sides of the chest, the axillæ, abdomen, and back. An excellent way to mercurialize a child is to put the ointment on the abdomen beneath a flannel binder. An efficient means also of favoring absorption is to apply the ointment to the soles of the feet, when it will be rubbed in by walking. Mercurial ointment is ordinarily used for this purpose, 15 to 30 grains (1.0–2.0 Gm.) being required for each inunction. Oleate of mercury when applied externally should not be rubbed in, the simple application to the skin being sufficient.

2. *Fumigation.*—The iodide, mercuric sulphide, and calomel are used in this manner. The latter preparation, being preferable, is the

one ordinarily used. From 5 to 20 grains (0.3–1.2 Gm.) of calomel are put in a plate or a porcelain dish over a lighted spirit-lamp. These are placed under a cane-bottomed chair, in which the patient sits, nude, enveloped in a blanket reaching to the floor and fastened loosely about the neck. The calomel is volatilized by the heat, deposited in minute particles over the surface of the body, and readily absorbed. The fumigation should last fifteen to twenty minutes.

3. *Endermically.*—Mercurials may be absorbed by dusting calomel and certain other preparations on ulcers, open wounds, etc.

4. *By the Rectum.*—Mercury may be administered in the form of a suppository containing 5 to 10 grains (0.3–0.6 Gm.) of mercurial ointment.

5. *Hypodermically.*—From $\frac{1}{12}$ to $\frac{1}{6}$ grain (0.005–0.01 Gm.) of the bichloride of mercury, dissolved in 5 to 10 minims (0.3–0.6 Cc.) of distilled water, is injected deeply into the muscles of the gluteal region or in the subcutaneous areolar tissue of the back. The solution of peptonate of mercury has been used for this purpose, though the preparation which is the least objectionable is the solution of the formamidate of mercury, 16 minims (1.0 Cc.), corresponding to $\frac{1}{6}$ grain (0.1 Gm.) of mercuric chloride.

A 1 per cent. solution of asparagin hydrargyrate has been highly recommended by Neumann for hypodermic use, the dose being about 15 minims (1.0 Cc.), equivalent to $\frac{1}{6}$ grain (0.01 Gm.).

Numerous other preparations have been recommended, but probably possess no advantage over those mentioned.

6. *Internally.*—In the treatment of *syphilis* nearly every preparation of mercury has been employed, authorities differing in their choice. Bumstead prefers the bichloride, the mercurous iodide, and the mercurial pill; Berkeley Hill, the red mercuric iodide; Fox, the cyanide; Hutchinson, the gray powder, etc. It matters little which of these preparations is used. That which agrees best with the patient is advisable. Calomel, gray powder, blue pill, and corrosive sublimate are ordinarily used in disorders of the alimentary tract. As a rule, the first two are preferable.

ARSENIC.

Ăcidum Arsenōsum — Ăcidi Arsenōsi — Arsenous Acid. *U. S. P.*

(Arsenic Trioxide—White Arsenic.)

Origin.—Arsenic has been found in minute proportions in many mineral waters. It is obtained in large quantities by roasting

arsenical ores—cobalt, nickel, tin, and particularly arsenical iron pyrites—and purifying by resublimation.

Description and Properties.—It is a heavy solid, occurring either as an opaque white powder or in irregular masses, of two varieties—the one, amorphous, transparent, and colorless, like glass; the other, crystalline, opaque, or white, resembling porcelain. Frequently the glassy variety is found enclosed in an opaque, white crust. Contact with moist air changes the glassy into the white, opaque variety. Both are odorless and tasteless.

Both varieties dissolve very slowly in cold water, the glassy variety requiring about 30, the porcelain-like about 80, parts of water at 15° C. (59° F.). Both are slowly but completely soluble in 15 parts of boiling water. Arsenous acid is but slightly soluble in alcohol, but is soluble in about 5 parts of glycerin. Oil of turpentine dissolves the glassy variety only. Both varieties are freely soluble in hydrochloric acid and in solutions of alkali hydrates and carbonates.

Dose.—$\frac{1}{60}$–$\frac{1}{20}$ grain (0.001–0.003 Gm.).

Official Preparations.

Līquor Ăcidi Arsenōsi—Liquōris Ăcidi Arsenōsi—Solution of Arsenous Acid.—Strength, 1 per cent. of arsenous acid.

Description and Properties.—A clear, colorless liquid, odorless, having an acidulous taste and an acid reaction.

Dose.—2–10 minims (0.12–0.6 Cc.).

Līquor Potăssii Arsenītis—Liquōris Potăssii Arsenītis—Solution of Potassium Arsenite (FOWLER'S SOLUTION).—Strength, 1 per cent. of arsenous acid.

Dose.—2–10 minims (0.12–0.6 Cc.).

Ărseni Iōdidum—Ărseni Iōdidi—Arsenic Iodide. *U. S. P.*

Origin.—Prepared by triturating in a mortar finely-powdered metallic Arsenic and Iodine until they are thoroughly mixed; or by mixing solutions of Arsenous and Hydriodic Acids, and evaporating.

Description and Properties.—Glossy, orange-red, crystalline masses, or shining, orange-red, crystalline scales, having an iodine-like odor and taste; gradually losing iodine on exposure to air and light. Soluble in 7 parts of water and in about 30 parts of alcohol. Arsenic iodide should be kept in glass-stoppered vials, in a cool place, protected from light.

Dose.—$\frac{1}{32}$–$\frac{1}{8}$ grain (0.002–0.008 Gm.).

Official Preparation.

Līquor Ărseni et Hydrărgyri Iōdidi—Liquōris Ărseni et Hydrărgyri Iōdidi—Solution of Arsenic and Mercuric Iodide—(DONOVAN'S SOLUTION).—**Strength:** 1 per cent., each, arsenic iodide and mercuric iodide.

Description and Properties.—A clear, pale-yellowish liquid, without odor, and having a disagreeable metallic taste.

Dose.—1–10 minims (0.06–0.6 Cc.).

Sōdii Ărsenas—Sōdii Arsenātis—Sodium Arsenate. *U. S. P.*

Origin.—Prepared by heating to redness Arsenous Acid, Sodium Nitrate, and Sodium Carbonate. Dissolve the fused mass in water, and crystallize. Dissolve crystals in water, and recrystallize.

Description and Properties.—Colorless, transparent, monoclinic prisms, odorless, and having a mild, alkaline taste (the salt is very poisonous). Efflorescent in dry air, and somewhat deliquescent in moist air. Soluble in 4 parts of water, very soluble in boiling water, and slightly soluble in cold water. Soluble in 60 parts of boiling alcohol. Sodium arsenate should be kept in well-stoppered bottles.

Dose.—$\frac{1}{60}$–$\frac{1}{10}$ grain (0.001–0.006 Gm.).

Official Preparation.

Līquor Sōdii Arsenātis—Liquōris Sōdii Arsenātis—Solution of Sodium Arsenate—(PEARSON'S SOLUTION).—**Strength:** 1 per cent. of sodium arsenate.

Dose.—1–10 minims (0.06–0.6 Cc.).

Unofficial Preparations.

Cūpri Ărsenis—Cūpri Arsenītis—Cupric Arsenite—(SCHEELE'S GREEN, MINERAL GREEN, PARIS GREEN, etc.).—*Dose*, $\frac{1}{100}$ grain (0.0006 Gm.), daily, in divided doses.

Līquor Ărseni Brōmidi—Liquōris Ărseni Brōmidi—Solution of Arsenic Bromide—(CLEMENS' SOLUTION).—Strength: the equivalent of 1 per cent. of arsenous acid.

Dose.—1–5 minims (0.06–0.3 Cc.).

Līquor Ărseni et Aŭri Brōmidi—Liquōris Ărseni et Aŭri Brōmidi—Solution of Arsenic and Gold Bromide.—Originated with, and recommended by, Dr. Barclay, and sold under the trade name "Arsenauro." Strength: 10 minims (0.6 Cc.) contain $\frac{1}{32}$ grain (0.002 Gm.) of each salt.

Dose.—5–15 minims (0.3–1.0 Cc.).

Antagonists and Incompatibles.—Arsenic is incompatible with the salts of iron, silver, magnesia, lime, copper, ammonium, and with vegetable astringents.

Synergists.—The Restoratives and nux vomica are synergistic to arsenic.

Physiological Action.—*Externally and Locally.*—Applied to the skin, arsenic acts as a caustic, exciting violent inflammation. Its escharotic influence results in destruction of vitality in the affected parts, accompanied with sloughing.

Internally.—Digestive System.—Except in very small doses arsenic acts as a severe gastro-intestinal irritant. Minute and medicinal doses stimulate the flow of gastric and intestinal juices, and augment peristalsis, improving the digestive and nutritive functions. When too long continued, the drug produces nausea, diarrhea, and increased micturition, with a sensation of heat and dryness of the throat and stomach. Toxic doses are followed by violent gastro-enteritis. Indeed, in whatever manner introduced into the system, arsenic appears to have a marked selective action upon the gastro-intestinal tract.

Circulatory System.—Cardiac action may be slightly stimulated by small doses, the experience of arsenic-eaters proving that the drug, so far from being necessarily deleterious, actually tends to invigorate the system. Large doses render the heart irritable and feeble and decrease the number of red corpuscles, rendering the blood less coagulable. Medicinal doses, while not increasing the number of red corpuscles, prevent their destruction in such diseases as pernicious anemia. Toxic doses induce, among other severe results, the characteristic arsenical symptom—fatty degeneration of the cardiac muscle. "In large doses—that is, more than 0.014 gramme ($\frac{1}{4}$ gr.)—it diminishes the excretion of urea and increases the excretion of phosphoric acid and chloride of sodium. In *small* doses, the elimination of uric acid being augmented, nutrition is increased because the chloride of sodium, the stimulant *par excellence* of nutrition and the preservative of the red corpuscles, is retained in the organism in larger quantities than normal, thus stimulating nutrition in spite of the loss of phosphoric acid. The contrary is the case when *large* doses are given, the unfavorable action being attributable first to the destructive effect of the drug on the red corpuscles, then to its action on the chloride of sodium, and finally to its action on the phosphoric acid."[1]

Nervous System.—The general effect of arsenic upon the brain and nervous system is that of a tonic—a property which is supposed to explain its antiperiodic nature, in which respect quinine alone is its superior. The cerebral functions are stimulated, even to the point of exhilaration. Experiments have shown that the sensory nervous apparatus is strongly and untowardly affected.

[1] *Annual of Universal Medical Sciences*, Issue of 1896, volume A, p. 32.

The action finally involves the motor system, complete paralysis supervening. Medicinal amounts act as a nervous excitant, stimulating the trophic apparatus (Hare). Large doses produce disorders of motility and sensibility, tremors, and other serious symptoms. It has been noted that the continued use of arsenic produces tingling and a sensation of numbness in the tips of the fingers.

Under prolonged use arsenic tends to accumulate to a greater extent in nervous than in other tissues. Thus, according to Scolosuboff, if 1 part is found in fresh muscle, the proportion in the liver is 10.8; in the brain, 36.5; in the spinal cord, 37.3.

Respiratory System.—Ordinary amounts effect no special change in respiration other than increased power and stimulation of the respiratory center. It has been held, with authority, that small doses stimulate the peripheral endings of the pulmonary vagi. In toxic doses arsenic acts as a powerful respiratory depressant.

Absorption and Elimination.—Arsenic is readily absorbed by the blood. Its presence has also been detected in the viscera, bile, urine, sweat, the bronchial and intestinal mucous membranes, and even in the parenchymatous tissues. It is eliminated slowly from the system by the intestines, and rapidly by the urine; possibly, also, by the bile and the skin. The saliva, milk, and even the tears, are said to share in the process of elimination.

Medicinal doses prevent tissue-change, while large doses increase nitrogenous metamorphosis. The therapeutic action is certainly to modify and improve nutrition.

Temperature.—The temperature is unaffected by medicinal doses. Toxic doses are accompanied by a considerable rise in bodily heat, though the extremities are often cold.

Eye.—Large doses of arsenic are followed by injection of the conjunctivæ, eczema, inflammation, and edema of the lids. Zehnder asserts that the prolonged administration of arsenic has caused retrobulbar neuritis, and Hutchinson believes vitreous opacities may result from such a course.

Untoward Action.—Differing from the characteristic symptoms of poisoning occasionally produced by medicinal doses in very susceptible persons, there are induced, not infrequently, restlessness, headache, alopecia areata, bronchitis, hoarseness, disturbances of digestion, thirst, coryza, and, in rare cases, epistaxis, anaphrodisia, icterus, lacrymation, photophobia, amblyopia, dermatitis, and various cutaneous eruptions, frequently followed by desquamation.

An eruption resembling that of measles, produced by 3 drops (0.18 Cc.) of Fowler's solution, is reported by Macnal (*Medical Times*

and Gazette, 1868). Falck reports a case in which arsenic produced a discolored sanguinolent eruption with erysipelatous swelling. Papules and erythematous pustules have also been observed.

The variety of these eruptions is well, yet somewhat homeopathically, described by Imbert-Gourbeyre (quoted from Lewin): "Éruptions pétéchiales ou ecchymoses, éruptions papuleuses, ortiées, vésiculeuses, érysipélateuses, pustuleuses, . . . telles sont les formes principales de l'arsenic, exanthématogène dans ses manifestations à la peau."

Poisoning.—Large doses of arsenic produce symptoms of *acute* poisoning, the drug almost immediately manifesting its characteristic effects upon the gastro-intestinal canal (to which it is a marked irritant), exciting active inflammation in its delicate membrane. Other symptoms are colicky pains in the stomach, looseness of the bowels, great pain in the esophagus, and edema of the face indicated by puffiness under the eyelids. The passages are at length similar to the "rice-water" discharges of cholera, although different from the latter in the presence of blood or serum. The purging becomes obstinate and exhausting. In certain cases other choleraic symptoms are especially manifested, as increasing coldness of the body and cramps. Among the more prominent symptoms is violent vomiting, which, however, aids in eliminating the poison from the stomach.

The effects of arsenic are somewhat variable, intestinal inflammation, as autopsies show, not always being present. The quantity requisite to produce poisoning is often dependent upon idiosyncrasy, minute doses having proved fatal, and large amounts followed by surprising recoveries. Frequently, in place of the usual symptoms, profound coma occurs from which the patient is, perhaps, never roused. Convulsions and localized paralysis have also been observed. It is well established, too, that absorption of arsenic from a wound or from injection into the blood causes stomachic and intestinal effects often as severe as those attending its ingestion.

Various cutaneous symptoms are recorded, and in some cases the effects of arsenical poisoning strongly resemble those of acute yellow atrophy of the liver.

Chronic Poisoning.—This malady is frequently due to the fumes or powder of arsenic inhaled in certain processes connected with the arts and manufactures or from manufactured products, such as wall-paper, certain dyes, textile fabrics, etc. The symptoms are similar to those accompanying full doses of the drug, save that

they appear occasionally in a more aggravated form. Ordinarily, loss of appetite occurs, with nausea, abdominal pains, vomiting, mild diarrhea, and headache. The conjunctivæ are injected, the eyes and nose watery. In severer cases peripheral neuritis may be induced, as well as herpes zoster and paralysis of the muscles of the limbs, particularly the extensors of the hands and feet. Ataxic gait and darting pains, with rapid loss of muscular power, are not infrequent. Death from arsenical poisoning, however, is commonly the result of gastro-enteritis or collapse.

The post-mortem changes are usually characteristic of corrosive poisoning—ecchymoses, erosions, and softening of the mucous membrane. The lungs and bronchial membrane are frequently congested. There is also present marked fatty degeneration of the heart, kidneys, liver, and spleen.

Treatment of Poisoning.—It is necessary that treatment be expeditious, and the agents and methods adopted carefully chosen. Vomiting often renders the use of the stomach-pump unnecessary, yet emetics are frequently serviceable, the cleansing of the stomach being of primary importance. Various antidotes have been successfully used, the best, chemically, being freshly prepared hydrated sesquioxide of iron, administered in water, 2 or 3 tablespoonfuls every fifteen or twenty minutes. Magnesia, chalk, and lime-water also serve as efficient antidotes. The temperature of the patient should be maintained, and demulcents (oil, milk, etc.) freely given. The after-treatment should include mucilaginous drinks, opiates if indicated, cathartics, and, in case of necessity, stimulants.

Therapeutics.—*Externally and Locally.*—The chief use of arsenic locally is as an escharotic. For this purpose it is employed to destroy malignant growths, such as *cancer, sarcoma of the skin*, and *multiple sarcomatous degeneration* of the lymphatic glands. In the latter affection the parenchymatous injection of 5 minims (0.3 Cc.) of Fowler's solution, diluted with twice the amount of distilled water, is used.

Many of the pastes and "quack" cancer remedies owe most of their efficiency to arsenic. Manec's paste contains arsenous acid, 15 grains (1.0 Gm.); black sulphide of mercury, 75 grains (5.0 Gm.); burnt sponge, 35 grains (2.3 Gm.).

The noted *poudre caustique de Frère Côsme ou du Rousselot* is a similar preparation, containing about the same quantity of arsenic.

The solution of arsenous acid is an excellent local application to *warts and corns*. If these growths are very firm and horny, their removal may be facilitated by the previous application of

solution of potassa. When used over large surfaces arsenic should be applied in good strength and heroically, so that active inflammation may be excited and the danger of absorption lessened.

Internally.—Arsenic is a peculiarly efficient remedy in *chronic scaly skin diseases.*

Like all other alteratives, it influences diseases of a chronic nature more favorably than acute disorders, invariably aggravating acute skin diseases. This drug, therefore, is one of the most valued remedies in *psoriasis*, *lepra*, and *chronic squamous eczema.*

While arsenic cannot, perhaps, be classed as an alterative in the above-mentioned diseases, it undoubtedly yields uniformly better results than any other single drug.

The solution of potassa is a valuable synergist to arsenic in these conditions, especially in eczematous cases.

Pemphigus, *prurigo*, *acne*, and *lichen ruber* have also been favorably influenced by the continued administration of Fowler's solution.

In the successful management of these chronic skin diseases it is necessary that the preparation of arsenic employed be given in as large doses as can be tolerated by the patient, and the treatment continued unremittingly for a long period.

Lymphoma, whether superficial or occupying the great cavities, is frequently benefited greatly by similar treatment.

Asthma and *bronchitis*, whether acute or chronic, accompanying or succeeding scaly skin diseases, are singularly amenable to this medicine when the dose is carried to the full physiological limit. Another condition, *dysmenorrhea*, frequently noticed in women with a tendency to asthma or subject to chronic diseases of the skin, is often cured or greatly benefited by arsenic.

The obstinate and often incurable disease known as *pernicious anemia* yields better to arsenic than to any other known remedy. The effect of the drug in this disease is not due to its increasing the number and quality of the red blood-corpuscles, but rather to its preventing or delaying their destruction in the portal circulation. It should be given continuously and in gradually increasing doses until symptoms of arsenical poisoning appear, when the increase should cease and the same dose be maintained for some time. By carefully watching the indications and by the timely use of laxatives the dosage may be easily adjusted so that the full benefit may be derived from this invaluable drug.

The statements in the preceding paragraph apply also to *leukemia*, whether *splenic*, *myelogenic*, or *lymphatic*, and to *Hodgkin's disease.*

Arsenic ranks next to quinine in the treatment of *malaria*. Chronic cases in which quinine has lost its power are generally benefited in a marked manner by arsenic. It is a peculiar fact that relapses are fewer after the arsenic treatment than after the use of quinine. Moreover, arsenic can be administered in *intermittent fever*, frequently with as favorable results as quinine would give.

Arsenic can be employed in cases of malaria at all times without regard to the presence or absence of fever or chills.

The *neuralgias*, *anemia*, and *headache* of malarial origin are singularly amenable to this medicine.

In the treatment of malaria with arsenic it must be remembered that the paroxysms of ague are not relieved at once, as is the case when quinine is the medicament used; but they recur with less severity, and are of shorter duration, gradually declining until they disappear altogether.

Fowler first reported the remarkable efficacy of arsenic in *neuralgia of the intercostal* and *fifth pair of nerves*. It is equally valuable in these cases whether the disease be due to malaria or to general debility.

The author wishes to recommend urgently the use of arsenic in *pulmonary phthisis*. In certain forms of this disease he regards it equal, if not superior, to any other remedy. It is useful, however, only in those conditions which are characterized by excessive expectoration and a slow degenerative process. The good results of the arsenic treatment in these cases is shown in a conspicuous manner by a marked improvement in the general condition of the patient, there being a lessened pulmonary secretion, a reduction in temperature, improvement of the appetite, and consequent increase of the body-weight. Arsenic is contraindicated in phthisis when the cough is harsh and paroxysmal, with but scanty expectoration and a tendency to pulmonary hemorrhage.

If this drug is specific in any one disease, it is so in *chorea*, very rarely failing to effect a cure when judiciously administered. It should be given in full doses, and increased as tolerance is established.

This medicine seems to act equally well in *gastralgia*. It is also an efficient remedy in *gastritis* or the vomiting of gastritis, especially in that occasioned by the excessive use of alcohol. Many *irritative conditions of the stomach* are relieved by minute doses of Fowler's solution. Excessive peristalsis, resulting in *diarrhœa*, coming on immediately after taking food, is usually cured completely by very small doses of Fowler's solution, alone or com-

bined with an equal quantity of tincture of opium. Arsenic has also been recommended in *gastric ulcer* and *cancer.*

It has proved of great service in *hay fever, spasmodic asthma,* and *acute coryza.* It is often very serviceable in *catarrhal pneumonia* and in *chronic bronchitis.* Bromide of arsenic is highly recommended in *diabetes mellitus. Rheumatoid arthritis* is more favorably influenced by the use of arsenic than by any other medicine. It should be employed in the treatment of *chronic rheumatism.* Even in *secondary syphilis* a combination of mercury and arsenic has produced better results, in some cases, than mercury alone. Anstie has recommended arsenic in *angina pectoris,* alleging that it mitigates the severity of the attacks. *Chronic diarrhea,* when induced by intestinal fermentation or chronic malarial infection, is sometimes greatly benefited by this drug. *Constipation,* also, if due to deficient intestinal secretion, may frequently be relieved by the administration of small doses of arsenic.

Albuminuria dependent upon imperfect digestion of albuminous substances is almost invariably relieved by Fowler's solution taken with meals.

Certain nervous diseases of the aged, not due to malaria, such as *melancholia* and *hypochondria,* are often relieved by small doses of this drug.

Finally, arsenic is a valuable adjunct to iron in the treatment of *simple anemia* and *chlorosis.* It is thought by some clinicians to retard the progress of *epithelioma,* and particularly *gastric* and *uterine cancer.*

Contraindications.—In acute skin diseases and pulmonary tuberculosis with a tendency to hemoptysis.

Administration.—Arsenic should be given ordinarily after meals. There are certain conditions, however, requiring its administration in small doses before meals. When it is desired to give arsenic in pill form, the arsenous acid should be used; and for solutions the liquor potassii arsenitis is usually preferred.

In syphilitic disorders Donovan's solution is an excellent preparation to use.

Children are much less susceptible to the drug than adults, often being able to take adult doses with impunity.

During a course of arsenic the patient should be instructed to watch carefully for the first untoward manifestations, such as puffiness about the eyes, itching of the conjunctivæ, nausea, diarrhea, or numbness of the fingers. Any one of these symptoms is an

indication that the dose should not be increased; and it may be necessary to lessen the dose, or even to discontinue the remedy altogether, for a while.

There are two methods of getting a patient thoroughly under the influence of the drug:

1. Begin with a full dose of Fowler's solution, and decrease 1 minim (0.06 Cc.) a day until a minim (0.06 Cc.) dose is reached; then repeat the method.

2. Begin with a small dose of Fowler's solution, and increase 1 minim (0.06 Cc.) a day until untoward symptoms appear or the dose has reached 10 or 15 minims (0.6–1.0 Cc.); then either repeat the method or decrease the amount 1 minim (0.06 Cc.) a day.

Enormous doses of arsenic can be given hypodermically, and it is then much less toxic than when given by the mouth. Equivalents of 20 (1.2 Cc.), 50 (3.2 Cc.), and indeed 100, minims (6.5 Cc.) of Fowler's solution have been given in this manner at a single dose without toxic symptoms. Arsenic often acts more efficiently when given in this manner than when given by the mouth. The liver has a strong elective affinity for arsenic, but it is absorbed through the alimentary canal with considerable difficulty. The toxic action expends itself almost wholly upon the stomach and upper portion of the intestine. The hypodermic use of arsenic distributes the drug through the system just as mercury is distributed by inunction, carrying it immediately to all parts of the system by the circulation. The arsenite of sodium is free from any objection for hypodermic use: it never causes the least sign of irritation. Fowler's solution is objectionable: it invariably causes much irritation, and frequently forms an abscess.

Careful study of the effects of the drug in each case will make it possible to guard its administration so that tolerance can be established—a result much to be desired in order to secure the maximum benefit.

Considering the enormous doses to which the arsenocophagi become habituated, failure in the medicinal administration of arsenic argues the want of ability to employ it scientifically.

Iōdum—Iōdi—Iodine. *U. S. P.*

Origin.—It is found in the ashes of sea-weeds and is prepared from the mother-liquor obtained in the purification of Chili saltpetre.

Description and Properties.—Heavy, bluish-black, dry and friable rhombic plates, having a metallic luster, a distinctive odor, and a sharp and acrid taste. It imparts a deep-brown, slowly evanescing stain to the skin, and gradually destroys vegetable colors. Iodine is soluble in about 5000 parts of water and in 10 parts of alcohol, with a brown color; also freely soluble in ether and in a solution of potassium iodide, with a brown color, and in chloroform or carbon disulphide, with a violet color. It should be kept in glass-stoppered bottles, in a cool place.

Dose.—About ¼ grain (0.016 Gm.), although seldom given in substance.

Official Preparations.

Līquor Iōdi Compŏsitus—Liquŏris Iōdi Compŏsiti—Compound Solution of Iodine (LUGOL'S SOLUTION).—Iodine, 5; Potassium Iodide, 10; Distilled Water, to make 100 parts. Strength, 5 per cent. *Dose*, 1–10 minims (0.06–0.6 Cc.).

Tinctūra Iōdi—Tinctūræ Iōdi—Tincture of Iodine.—Iodine, 70; Alcohol, to 1000. Strength, 7 per cent. *Dose*, 1–5 minims (0.06–0.3 Cc.).

Unguĕntum Iōdi—Unguĕnti Iōdi—Iodine Ointment.—Iodine, 4; Potassium Iodide, 1; Water, 2; Benzoinated Lard, 93. Strength, 4 per cent. For external use.

Sўrupus Ăcidi Hydriōdidi—Sўrupi Ăcidi Hydriōdidi—Syrup of Hydriodic Acid. *U. S. P.*

A syrupy liquid containing about 1 per cent. by weight of hydriodic acid.

Description and Properties.—A transparent, colorless, or only pale straw-colored liquid, odorless, and having a sweet and acidulous taste.

Dose.—½–2 fluidrachms (2.0–8.0 Cc.).

Ammōnii Iōdidum—Ammōnii Iōdidi—Ammonium Iodide. *U. S. P.*

Origin.—It is prepared by dissolving Potassium Iodide and Ammonium Sulphate in boiling Water, adding Alcohol, filtering, washing the filtrate, and evaporating it to dryness.

Description and Properties.—Minute, colorless, cubical crystals, or a white, granular powder, without odor when colorless, but emitting a slight odor when colored, and having a sharp, saline taste. The salt is hygroscopic, and soon becomes yellow, or yellowish-brown, on exposure to the air and light, owing to the loss of ammonia and the elimination of iodine. Soluble in 1 part

of water and in 9 parts of alcohol. Ammonium iodide should be kept in small, well-stoppered vials, protected from light.

Dose.—3–20 grains (0.18–1.2 Gm.).

Potăssii Iōdidum—Potăssii Iōdidi—Potassium Iodide. *U. S. P.*

Origin.—Iodine is dissolved in a solution of Potassa in hot distilled Water. The solution is evaporated, and the residue heated with charcoal. Dissolve in boiling Water, filter, wash the filtrate, and crystallize.

Description and Properties.—Colorless, transparent or translucent, cubical crystals, or a white, granular powder, having a peculiar, faint, iodine-like odor, and a pungent, saline, and afterward bitter taste. Permanent in dry air and but slightly deliquescent in moist air. Soluble in 0.75 part of water and in 18 parts of alcohol; also soluble in 2.5 parts of glycerin. Potassium iodide should be kept in well-stoppered bottles.

Dose.—2–30 grains (0.12–2.0 Gm.).

Official Preparation.

Unguĕntum Potăssii Iōdidi—Unguĕnti Potăssii Iōdidi—Ointment of Potassium Iodide.—Potassium Iodide, 12; Sodium Hyposulphite, 1; Water, 10; Benzoinated Lard, 77. For external use.

Sōdii Iōdidum—Sōdii Iōdidi—Sodium Iodide. *U. S. P.*

Origin.—Prepared from a solution of Soda in a manner similar to the preparation of potassium iodide.

Description and Properties.—Colorless, cubical crystals, or a white, crystalline powder, odorless, and having a saline and slightly bitter taste. In moist air it deliquesces and becomes partially decomposed into sodium carbonate and free iodine, assuming thereby a reddish color. Soluble in 0.6 part of water and in about 3 parts of alcohol. It should be kept in well-stoppered bottles.

Dose.—2–30 grains (0.12–2.0 Gm.).

Strŏntii Iōdidum—Strŏntii Iōdidi—Strontium Iodide. *U. S. P.*

Origin.—Prepared by neutralizing freshly prepared solution of Hydriodic Acid with Strontium Carbonate, concentrating the filtrate, and crystallizing.

Description and Properties.—Colorless, transparent, hex-

agonal plates, odorless, and having a bitterish, saline taste; deliquescent and colored yellow by exposure to air and light. Soluble in 0.6 part of water, also soluble in alcohol, and slightly in ether. It should be kept in dark, amber-colored, glass-stoppered vials.

Dose.—2–30 grains (0.12–2.0 Gm.).

Zĭnci Iōdidum—Zĭnci Iōdidi—Zinc Iodide. *U. S. P.*

Origin.—Obtained by dissolving Zinc Oxide or Carbonate in Hydriodic Acid, or digesting Granulated Zinc in 10 parts of Iodine and 20 parts of Water, and evaporating to dryness.

Description and Properties.—A white, granular powder, odorless, and having a sharp, saline, and metallic taste. Very deliquescent, and liable to absorb oxygen from the air and to become brown from liberated iodine. Readily soluble in water, alcohol, or ether. Zinc iodide should be kept in small, glass-stoppered bottles.

Dose.—1–3 grains (0.06–0.18 Gm.).

Sŭlphuris Iōdidum—Sŭlphuris Iōdidi—Sulphur Iodide. *U. S. P.*

Origin.—Prepared by heating Washed Sulphur and Iodine in a flask until the ingredients combine.

Description and Properties.—Brittle masses, of a crystalline fracture and a grayish-black, metallic luster, having the odor of iodine and a somewhat acrid taste. Almost insoluble in water; soluble in about 60 parts of glycerin; very soluble in carbon disulphide. Alcohol and ether dissolve out the iodine, leaving the sulphur. Sulphur iodide should be kept in glass-stoppered bottles, in a cool place.

Dose.—1–5 grains (0.06–0.3 Gm.).

Unofficial Preparation.

Unguĕntum Sŭlphuris Iōdidi—Unguĕnti Sŭlphuris Iōdidi—Ointment of Sulphur Iodide.—Sulphur Iodide, 30 grains (2.0 Gm.); Lard, 1 ounce (30.0 Gm.). For external use.

Plŭmbi Iōdidum—Plŭmbi Iōdidi—Lead Iodide. *U. S. P.*

Origin.—Mix solutions of Lead Nitrate and Potassium Iodide, filter, wash the precipitate with Distilled Water, and dry it at a gentle heat.

Description and Properties.—A heavy, bright-yellow powder, without odor or taste. Permanent in the air. Soluble in 2000 parts of water; very slightly soluble in alcohol, but soluble, without color, in solutions of the fixed alkalies, in concentrated solutions of the acetates of the alkalies, of potassium iodide, and of sodium hyposulphites, and in a hot solution of ammonium chloride. Lead iodide should be kept in well-stoppered bottles, protected from light.

Dose.—$\frac{1}{6}$ grain (0.013 Gm.), although, as a rule, this drug is employed externally.

Argĕnti Iōdidum—Argĕnti Iōdidi—Silver Iodide. *U. S. P.*

Origin.—Aqueous solutions of Silver Nitrate and of Potassium Iodide are poured together; the precipitate is then collected upon a filter and washed with Distilled Water and dried upon bibulous paper.

Description and Properties.—A heavy, amorphous, light-yellowish powder, unaffected by light if pure, but generally becoming somewhat greenish-yellow, and having neither odor nor taste. Insoluble in water and alcohol.

Dose.—$\frac{1}{8}$–2 grains (0.008–0.13 Gm.).

Allied Compounds.

Iōdi Brōmidum—Iōdi Brōmidi—Bromide of Iodine.—*Origin.*—Obtained by heating together Iodine and Bromine.

Description and Properties.—A dark, reddish-brown liquid, resembling bromine in appearance and sensible properties, but yielding a perfectly transparent, brown-red solution with less than 6 parts of water. For external use.

Iōdi Chlōridum—Iōdi Chlōridi—Iodine Chloride (Iodine Trichloride).—*Origin.*—Prepared by passing dry Chlorine Gas over dry Iodine.

Description and Properties.—Orange-yellow needles, gradually changing to large, transparent, rhombic plates. It has a penetrating, pungent odor, resembling bromine. Soluble in 5 parts of water, and also in alcohol and ether.

Dose.—$\frac{1}{8}$ grain (0.01 Gm.), and externally in $\frac{1}{10}$–$\frac{1}{5}$ per cent. aqueous solution.

Antagonists and Incompatibles.—Iodine and the iodides are antagonized by most of the Restoratives. Iodine is incompatible with the alkaloids and most of the mineral salts and acids, and with ammonia. The iodides are incompatible with mineral acids and acid salts, bismuth subnitrate, alkaloids, silver nitrate, soluble lead salts, spirit of nitrous ether, potassium chlorate, liquorice, and

preparations containing starch. The tincture of iodine is incompatible with water and aqueous preparations.

Synergists.—The specifics, alkalies, and remedies increasing waste.

Physiological Action.—*Externally and Locally.*—Iodine is a powerful disinfectant and rubefacient, as well as vesicant, caustic, parasiticide, and antiseptic. When applied to the skin or mucous membrane it produces a yellow, brown, or black stain, and is irritant or caustic according to the strength and frequency of the application. The discoloration, however, can be easily removed by sodium hyposulphite or ammonia.

It combines with the albumin of the tissues and prevents putrefactive changes. When tincture of iodine is frequently applied or large amounts are used, desquamation of the skin is produced, and sometimes rapid vesication, or perhaps sloughing. The blood-vessels of the organs subjacent to the area to which it is applied are reflexly dilated, rendering this drug an efficient counter-irritant.

The vapor of iodine when inhaled produces considerable irritation of the respiratory passages, exciting cough, sneezing, increased secretion of mucus, dyspnea, and more or less pain in the chest, although when inhaled in moderate amounts its antiseptic properties exert a beneficial influence upon the bronchial tissues, preventing decomposition of the secretions.

The iodides have no local action.

Internally.—Digestive System.—Taken internally in small doses, IODINE acts as a gastric tonic, minute doses acting as a sedative, allaying nausea. In other cases a single moderate dose may occasion gastric uneasiness, larger amounts intensifying the discomfort and causing violent vomiting, increased salivary flow, abdominal pains, and purging.

The IODIDES in moderate doses produce a sense of warmth in the stomach, larger amounts acting like iodine, though less irritating to the gastro-intestinal tract than the latter drug.

Owing to their rapid diffusibility, the iodides can be tasted in a few minutes after their ingestion, considerably increasing the flow of saliva.

Circulatory System.—The effects of iodine and its salts have been variously reported, it being claimed that their tendency is to contract the vessels and cause increased cardiac action. Introduced into the veins, a slight increase, followed by decrease of pressure, has been observed. The rapidity of elimination from the

blood is doubtless an impediment to any marked action on the circulation. Trasbot claims that potassium iodide dilates the blood-vessels, thereby increasing glandular secretion.

The iodides are all supposed to be converted into the sodium iodide in the blood, without modifying the composition of that fluid.

Nervous System.—No special action is recorded, although the potassium iodide is known to occasion unpleasant symptoms, including distress of mind and depression of spirits, accompanied now and then by lassitude and muscular debility—symptoms due rather to the influence of potassium upon the spinal cord.

Respiratory System.—Little or no effect from medicinal doses has been noted.

Absorption and Elimination.—Iodine and the iodides are rapidly absorbed by the mucous membranes generally, being found in the blood, mainly in combination with sodium.

Elimination takes place by various channels—the urine, saliva, milk, intestinal and nasal mucous membranes. Salivary elimination appears to be even more active than the urinary process, although the drug escapes largely through the kidneys, increasing the amount of water, urea, uric acid, and phosphoric and sulphuric acids excreted. At the points of elimination the iodine escapes in its nascent state, occasioning more or less irritation.

Temperature.—No effects have been noted, the temperature appearing to remain stationary even in the presence of decidedly untoward symptoms.

Eye.—Beyond a local congestion of the minute vessels of the sclerotic coat under certain conditions little effect has been observed. The symptoms of ocular iodism at times present are described under "Poisoning."

Uterus.—Small doses may increase or hasten the menstrual flow and act as aphrodisiacs; larger doses have a marked anaphrodisiac effect; while prolonged administration may result in atrophy of the ovaries. It has been maintained with authority that the catamenia are liable to increase, and that during pregnancy the drug may cause abortion.

Untoward Action.—The untoward manifestations, in susceptible patients, are identical with those of iodism.

Poisoning.—Taken in excessive doses, iodine acts as a poison, and has even produced death, though rarely. The symptoms of

acute poisoning are those of severe gastro-enteritis, characterized by distressing stomachic and abdominal pains, accompanied by painful irritation of the esophagus, followed by violent purging and vomiting.

An early symptom is a strong metallic taste in the mouth, together with increased salivation. Suppression of urine, hiccough, and dysenteric pain have been reported in a fatal case resulting from external application (Biddle, p. 460). Very immoderate doses are attended with rapid and feeble pulse, deathly pallor, severe renal irritation affecting urinary secretion, and final loss of vital power followed by respiratory failure.

The condition induced by prolonged or excessive use of iodine or its salts is known as *Iodism*. Together with a metallic taste there are present tenderness of the teeth and gums, nausea and coryza or symptoms of gastric irritation, acneiform eruptions—even a vesicular and purpuric variety not infrequently occurs—while under continued dosage the coryza becomes more pronounced, accompanied by edema of the eyelids, lacrymation, and ocular pains. Moreover, muscular twitchings, edema of the glottis, neuralgic pains, and atrophy of mammæ, testicles, and other tissues occasionally supervene. Anemia and even cachexia are often manifest.

Treatment of Poisoning.—The use of large amounts of starch, in the form of arrowroot or starch-water, has been successfully adopted as an antidote. Hypodermic injections of ammonia, strychnine, digitalis, alcohol, and atropine have been employed with excellent results, as tending to restore the circulation and assist respiratory movements. More recently bicarbonate of sodium has proved an efficient antidote.

The use of the stomach-pump and the application of heat to the body and extremities are naturally of the first importance.

Therapeutics.—*Externally and Locally.*—The TINCTURE, COMPOUND SOLUTION, and OINTMENT are extensively employed as counter-irritants and as aids to the absorption of fluid. The tincture is an efficient application to joints in *chronic rheumatism*, *gout*, and *synovitis*, and in *pleurisy*, both for the purpose of aborting an attack and to aid the absorption of fluid when effusion has taken place. In *neuritis*, *onychia*, *periostitis*, *venereal bubo*, *glandular swellings*, etc. the tincture, applied externally, will often be of service.

This same preparation is of marked benefit when hypodermi-

cally injected in *goiter*, particularly of the soft or cystic variety, *hydrocele, empyema, extensive serous arthritic effusion* unaccompanied by inflammation, *spinal meningocele*, and *anal fistula.*

The tincture is also a very efficient application in *chronic metritis* and *chronic endometritis.*

In many diseases of the skin iodine serves a useful purpose as a discutient and parasiticide, *lentigo, lupus, chloasma, tinea tonsurans*, etc. especially indicating its use.

Many chronic *splenic* and *hepatic disorders* are favorably influenced by an external application of the iodine ointment.

The TINCTURE OF IODINE has been recommended as an efficient application in recession of the gums attendant upon *pyorrhœa alveolaris.*

The vapor of iodine is frequently employed in subacute *catarrhal deafness* and in *acute coryza.*

A mixture of tincture of iodine ½ fluidrachm (2.0 Cc.), carbolic acid 10 minims (0.6 Cc.), glycerin and water, each, 1½ ounces (45.0 Cc.), has been highly recommended by Samuel Johnston in the treatment of *chronic pharyngitis.*

As an inhalant in *chronic laryngitis* and *phthisis* iodine in some form is highly esteemed by many physicians.

Internally.—One of the principal and most important uses of iodine and the iodides is in the treatment of secondary and tertiary *syphilis.* All the manifestations of this disease, such as *syphilitic periostitis, meningitis, endarteritis, gummata, paralysis*, etc., are relieved by large doses of the iodides to saturation of the system. The more chronic the disease, the larger the dose required; and the more acute the attack, the smaller the dose.

Iodine is peculiarly useful in combining with and eliminating mercury from the system of patients suffering from *mercurial cachexia, paralysis*, etc. Other metals, lead, etc., are readily eliminated by a course of potassium iodide.

POTASSIUM IODIDE is of marked utility in arresting the various manifestations of *scrofula*, such as *inflammation* and *ulceration of cartilaginous structures* and *mucous catarrhs*, and hastening the resolution of *adenitis* and *enlargement of lymphatics.*

With regard to the use of iodine in the treatment of *aneurysm of the aorta* Walshe says: "Not only has relief of neuralgic pains and of the general distress followed its administration, but the local pressure-symptoms have been mitigated, and firm thrombosis has taken place within the sac, while the area of pulsation and of per-

cussion-dulness has exhibited sensible reduction." Other authorities have reported favorably of its use in this condition.

As a cardiac tonic iodine is of undoubted value, being especially serviceable in *fatty degeneration of the heart*, and in usually mitigating the symptoms of *chronic valvular diseases of the heart*, especially those of the aortic orifice. It is a particularly useful remedy in *chronic asthma* and *bronchitis*, and to hasten the removal of inflammatory products of *pneumonia*, *pleurisy*, and *pericarditis*.

The *spasmodic asthma* of adults and the *bronchitis* of children, both of which alternate with eczematous attacks, are greatly relieved by the potassium iodide.

Even *hereditary asthma* occurs at less frequent intervals and in a milder form when the patient is kept constantly under the influence of moderate doses of this drug. And if there is any remedy which has a beneficial influence in *acute tubercular meningitis*, it is potassium iodide.

In the early stages of *cirrhosis*, whether of the liver or kidneys, as well as in *sclerosis of the cord*, it is an efficient remedy. The *dropsy* of *splenic* or *hepatic induration* is relieved by iodine, while in the various forms of *muscular rheumatism* it is one of the most potent medicaments. It has been advocated as a successful remedy in *sciatica* and *chronic gout*.

It unquestionably retards the changes in *chronic interstitial nephritis*, though the tincture of iodine in these cases is considered superior to the potassium iodide.

Ammonium iodide is highly recommended as an efficient remedy in acute *catarrhal pneumonia* and *capillary bronchitis*. It is especially useful in catarrhal jaundice, and has, moreover, been suggested as a good remedy in *hay fever* and in *malarial fevers*.

The syrup of hydriodic acid has been commended by Craig as a valuable agent in *acute rheumatism*. Small doses of the *tincture of iodine* have been found efficient in the *vomiting of pregnancy*.

Contraindications.—The drug should be discontinued at once when symptoms of iodism appear. It is contraindicated also in pulmonary tuberculosis when there is rapid change taking place in the lung. The iodides should not be given immediately before or after the administration of quinine.

Administration.—The sodium iodide is less active and toxic than the potassium salt. The strontium iodide may be used for the same purposes as the other iodides, and possesses the advantage of disturbing the stomach less, besides being less likely to produce iodism.

The iodides should be given in a large quantity of liquid. Their unpleasant taste may be concealed to a considerable extent by dissolving them in carbonic-acid water or Vichy water. Milk, compound syrup of sarsaparilla, and currant and raspberry syrups have all been used for this purpose.

It is said that tincture of belladonna or sodium bicarbonate prevents the coryza caused by the iodides.

The syrup of hydriodic acid is quite pleasant to the taste, and has but little tendency to produce iodism or untoward effects. This preparation should always be administered upon an empty stomach.

Cŏlchicum—Cŏlchici—Colchicum. *U. S. P.*

(Meadow Saffron.)

Origin.—A plant indigenous in Europe, in the southern and central portions of which it is frequently found in pastures and meadows, flowering in September or October, and ripening its seeds in June following. The root and seeds are official.

Description and Properties.—*The root* is about 1 inch (25 Mm.) long, ovoid, flattish, with a groove on one side; externally brownish and wrinkled, internally white and solid; often in transverse slices reniform in shape, and breaking with a short, mealy fracture; inodorous; taste sweetish, bitter, and somewhat acrid.

Dose.—2–8 grains (0.12–0.5 Gm.) in powder.

Official Preparations of the Root.

Extrăctum Cŏlchici Rădicis—Extrăcti Cŏlchici Rădicis—Extract of Colchicum Root.—*Dose*, ½–2 grains (0.03–0.12 Gm.).

Extrăctum Cŏlchici Rădicis Flŭidum—Extrăcti Cŏlchici Rădicis Flŭidi—Fluid Extract of Colchicum Root.—*Dose*, 2–8 minims (0.12–0.5 Cc.).

Vīnum Cŏlchici Rădicis—Vīni Cŏlchici Rădicis—Wine of Colchicum Root.—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Colchicum seeds are subglobular, about $\frac{1}{12}$ inch (2 Mm.) thick, very slightly pointed at the hilum; reddish-brown, finely pitted, internally whitish; very hard and tough; inodorous; taste bitter and somewhat acrid.

Both the root and seeds contain an active alkaloid, *colchicine*, which is present in greater proportion in the root.

Dose of the Powdered Seeds.—1–5 grains (0.06–0.3 Gm.).

Dose of Colchicine.—$\frac{1}{100}$–$\frac{1}{60}$ grain (0.0012–0.001 Gm.).

Official Preparations of the Seed.

Extractum Colchici Seminis Fluidum—Extracti Colchici Seminis Fluidi—Fluid Extract of Colchicum Seed.—*Dose*, 1–5 minims (0.06–0.3 Cc.).

Tinctura Colchici Seminis—Tincturæ Colchici Seminis—Tincture of Colchicum Seed.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Vinum Colchici Seminis—Vini Colchici Seminis—Wine of Colchicum Seed.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Antagonists and Incompatibles.—Alcohol and opium antagonize the cardiac depression produced by colchicum. Tannic acid and vegetable infusions containing it are incompatible, forming an insoluble tannate with the alkaloid.

Synergists.—Diuretics, purgatives, emetics, and alkalies promote the therapeutic activity of colchicum.

Physiological Action.—*Externally and Locally.*—Colchicum is a decided local irritant, and when applied to the skin acts as a rubefacient. The dust when inhaled excites sneezing.

Internally.—Digestive System.—In small medicinal doses colchicum slightly stimulates the salivary, gastric, biliary, and intestinal secretions. If these doses are repeated for several days, a sensation of heat is experienced in the epigastrium, accompanied by loss of appetite and frequently by nausea. Full medicinal doses may produce purging and colic. Larger doses occasion profuse watery and choleriform or bloody evacuations from the bowels, severe abdominal pain and tenderness, excessive vomiting—in fact, all the symptoms produced by a violent gastro-intestinal irritant.

Circulatory System.—Full medicinal or larger doses produce great depression of the circulation, with a small, rapid, and thready pulse. The marked cardiac depression and collapse which occur when poisonous doses of colchicum have been taken are more the result of the severe gastro-enteritis than of any direct action upon the heart.

Nervous System.—The nervous system is unaffected by medicinal doses. Even when poisonous doses have been taken the intellect usually remains unimpaired, though Toulmouche has seen the drug induce marked cerebral excitement. Discordant statements have been made regarding the action of colchicum upon the nervous system. The drug evidently affects different persons differently. Thus numbness or prickling, muscular pains or spasms, and occasionally convulsions, have been noticed; yet the recent investigations of Laborde and Houdé upon the action of colchicine show that it has no influence upon the centers of intelligence and

volition, and does not induce paralysis of central origin, either motor or sensory, though the sensory nerves are considerably depressed.

Respiratory System.—Large or poisonous doses of colchicum render the respiratory movements slow and shallow. This action is not due to any direct effect upon the respiratory center—although Rossbach and Wehmer maintain the contrary—but reflexly to the depression occasioned by the violent action of the drug upon the gastro-intestinal tract.

Absorption and Elimination.—Colchicum is quite rapidly absorbed, and is eliminated chiefly by the bowels and kidneys, the skin sharing to some extent in the excretory process. Some observers allege that colchicum does not increase the amount of urine or the excretion of urea and uric acid, while others claim that these substances are increased. The author's experiments are sufficient to satisfy him that the excretion of all these substances is considerably heightened under medicinal doses of colchicum.

Temperature.—Under moderate medicinal doses the temperature is unaffected, though doses large enough to produce emeto-catharsis are followed by a reduction of temperature.

Untoward Action.—Many symptoms described under "Poisoning" have been produced by very small doses. It is a matter of speculation whether these untoward manifestations were due to a decided idiosyncrasy on the part of the patient, or to the fact that the preparation employed might have contained an unusually large percentage of the alkaloid.

Poisoning.—The symptoms of poisoning by colchicum are violent vomiting and purging, griping and intense pain in the abdomen, and at times excessive salivation or possibly convulsions. While death is for a time delayed under a poisonous dose, a fatal termination is almost inevitable. Meanwhile the patient suffers excruciatingly, being little relieved by treatment.

Treatment of Poisoning.—All that can be done is to combat symptoms, giving opium for pain, oil and demulcent drinks for the irritation, and stimulants to counteract respiratory and cardiac depression. Washing out the stomach or the use of emetics may be required. Tannic acid serves as a partial antidote, precipitating the colchicine.

Therapeutics.—*Externally and Locally.*—Colchicum has no local therapeutic action.

Internally.—Colchicum is the typical vegetable specific. Its

effects are in many ways analogous to those of mercury and iodine, even resulting in fatty degeneration of the liver, loss of hair, nails, teeth, etc.

The drug is as valuable and certain a specific for *gout* as is mercury for syphilis. Gout in all its varied manifestations is relieved by this invaluable remedy. *Diarrhea, dysentery, dyspepsia, bronchitis, asthma, neuralgia,* and *eczema dependent upon a gouty condition* are singularly benefited by colchicum.

This medicine, while at times efficacious in *chronic rheumatism,* and occasionally of some benefit in *rheumatoid arthritis,* is of no value in acute articular rheumatism.

Its value is more apparent in acute than in chronic gout, and in the first attacks than in succeeding ones. Chronic gout, as well as chronic rheumatism, yields better to a combination of colchicum and potassium iodide than to colchicum alone.

Some physicians recommend hypodermic injections of colchicine into the sheath of the nerve in *sciatica.* The author's quite limited use of this method has resulted in so much local irritation that he is prompted to caution the reader against the hypodermic employment of this drug.

In combination with certain other agents colchicum serves an excellent purpose as a cholagogue, full doses being frequently very effective in relieving *ascites* due to obstructive diseases of the liver.

Colchicum is sometimes employed as a drastic purgative in *cerebral* and *portal congestion,* although when given in doses sufficient for this purpose it occasions considerable nausea and abdominal distress.

Colchicum has also been recommended in the treatment of *gonorrhea* and *chordee.*

In doses of $\frac{1}{64}$ grain (0.001 Gm.) colchicine has been suggested by Darier in certain inflammatory *diseases of the eye. Hypochondriasis* resulting from renal insufficiency is frequently benefited by colchicum.

Contraindications.—The drug would be contraindicated in acute inflammatory conditions of the gastro-intestinal tract. It should be cautiously administered to old people.

Administration.—The liquid preparations are to be preferred, and, in order to secure the full curative effects of the drug, it is unnecessary to give it in doses sufficiently large to excite vomiting or purging. The initial dose, therefore, should be small, that it may occasion no gastric disturbance.

The beneficial effects of colchicum may be enhanced by first emptying the intestinal canal by means of a saline cathartic.

The preparations of colchicum vary greatly in strength. The crude drug contains different percentages of the alkaloid, according to the season of the year in which the plant is gathered, the colchicum root collected in July and August containing the largest percentage of colchicine. Owing to this variation in strength the assayed tincture or the alkaloid is recommended as the best preparation to use, though, because of its activity and poisonous properties, the alkaloid should be given in very small doses at first—not to exceed $\frac{1}{120}$ of a grain (0.0005 Gm.) two or three times a day.

Guaïaci Lignum—Guaïaci Ligni—Guaiacum Wood. *U. S. P.*

(Lignum Vitæ.)

Origin.—The heart-wood of *Guaiacum officinale* L. and of *Guaiacum sanctum* L., trees indigenous in the West Indies and on the northern coast of South America. The former is about 40 feet (12 M.) high, having evergreen pinnate leaves.

Description and Properties.—The wood is heavier than water, hard, brown or greenish-brown, resinous, marked with irregular concentric circles surrounded by a yellowish alburnum; splitting unevenly, when heated emitting a balsamic odor; taste slightly acrid. It contains from 20 to 25 per cent. of resin, its most important constituent.

Dose.—$\frac{1}{4}$–1 drachm (1.0–4.0 Gm.).

Official Preparation.

Guaiacum wood is contained in Decoctum Sarsaparillæ Compositum, for which see *Sarsaparilla*.

Guaïaci Resina—Guaïaci Resinæ—Guaiac. *U. S. P.*

Origin.—The resin of the wood of *Guaiacum officinale*.

Description and Properties.—Irregular masses or subglobular pieces, externally greenish-brown, internally of a glassy luster, and in recent guaiac usually reddish-brown, transparent in thin splinters, fusible, feebly aromatic, the odor becoming stronger upon heating; taste somewhat acrid; powder grayish, turning green on exposure to air. Soluble in potassium or sodium hydrate T. S. and in alco-

hol, the alcoholic solution being colored blue by the addition of tincture of ferric chloride.

The principal constituents of guaiac are—guaiaconic acid, guaiacic acid, guaiaretic acid, and a small amount of gum. These substances are insoluble in water, but soluble in alkalies.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparations.

Pĭlulæ Antimōnii Compŏsitæ—Pĭlulas (acc.) **Antimōnii Compŏsitas—Compound Pills of Antimony** (PLUMMER'S PILLS).—*Dose*, 1 or 2 pills.

Tinctūra Guaïaci—Tinctūræ Guaïaci—Tincture of Guaiac.—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Tinctūra Guaïaci Ammoniāta—Tinctūræ Guaïaci Ammoniātæ—Ammoniated Tincture of Guaiac.—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Unofficial Preparation.

Emŭlsum Guaïaci—Emŭlsi Guaïaci—Guaiac Emulsion.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Antagonists and Incompatibles.—Spirit of nitrous ether and the mineral acids are incompatible with guaiac. Water is pharmaceutically incompatible with the tinctures, precipitating the resin.

Synergists.—Many of the diaphoretics and diuretics aid the action of guaiac. Colchicum, sarsaparilla, mezereum, stillingia, sassafras, sanguinaria, and xanthoxylum are also synergistic.

Physiological Action.—*Externally and Locally.*—Guaiac is antiseptic, and possesses mildly astringent properties, being used locally as a gargle.

Internally.—Digestive System.—It increases the flow of saliva and gastric juice, producing a sensation of warmth in the epigastrium. It also augments the secretions from the intestinal canal, excessive doses even causing vomiting and purging.

Circulatory System.—Guaiac increases the force and rapidity of the heart's action and dilates the cutaneous blood-vessels.

Nervous System.—No special action has been observed.

Respiratory System.—The drug is an expectorant, increasing the production and excretion of bronchial mucus.

Absorption and Elimination.—Though a colloidal substance, it is absorbed into the blood with considerable facility, being excreted chiefly by the skin, exciting free diaphoresis. The bowels, kidneys, and bronchial mucous membrane assist in the excretory process.

Temperature.—Under doses sufficient to cause free diaphoresis

the temperature may be reduced. Guaiac has, however, no direct influence upon the heat-center.

Uterus.—Large doses of guaiac induce contraction of the womb, the drug thus acting as an ecbolic.

Untoward Action.—No special symptoms are manifest other than the gastro-intestinal disturbance mentioned, and occasionally headache and giddiness.

Poisoning.—Guaiac cannot be classed as a poisonous substance. Excessive doses act as a gastro-intestinal irritant, although no case of death is recorded resulting directly from this drug.

Treatment of Poisoning.—This should be symptomatic, and similar to the treatment of poisoning from colchicum.

Therapeutics.—*Externally and Locally.*—Guaiac in some form is an excellent application in *follicular tonsillitis*, *rheumatic pharyngitis*, and *quinsy*. For these cases the emulsion of guaiac serves as an efficient gargle, or the troches of guaiac may be used.

Internally.—From the sixteenth to the eighteenth century guaiac was renowned as a cure for *syphilis*, having been introduced into Europe from San Domingo. The heroic manner, however, in which the drug was employed rendered the results more injurious than beneficial, so that the guaiac treatment was condemned, one of its most vigorous opponents being Paracelsus, to whom the reintroduction of mercury for the treatment of syphilis is largely due. Since we have learned to use mercury and iodine and its preparations intelligently the guaiac treatment of this disease possesses only a historic interest. Nevertheless, the drug possesses properties which render it exceedingly valuable in *chronic muscular rheumatism*, *neuralgic dysmenorrhea*, and *atonic amenorrhea*.

Guaiac is considered to be an efficient remedy in *lumbago* and *chronic gout*. Its most important service, however, in therapeutics is in the treatment of *quinsy*. It is doubtful whether there is any drug which will modify the course of this disease or abort an attack of tonsillitis so readily as this medicine. The tincture of guaiac is the preparation usually employed for this purpose, ½ fluidrachm (2.0 Cc.) being given in the form of an emulsion every three or four hours.

Contraindications.—There are no marked contraindications to its use.

Administration.—The tinctures are very acrid and disagreeable to the taste, and should be given in the form of an emulsion. The emulsion of guaiac, a formula for which is given in the Dispensa-

tories, is not unpleasant, and is altogether the best liquid preparation to give.

The lozenges of guaiac, allowed to dissolve slowly in the mouth, serve as an agreeable and efficient method of medicating the throat with this drug.

Sarsaparilla—Sarsaparillæ—Sarsaparilla. *U. S. P.*

Origin.—The root of *Smilax officinalis* Kunth and other species of Smilax growing in swampy forests in Mexico and as far south as the northern portion of Brazil. They are woody climbers, often attaining a great height.

Description and Properties.—About $\frac{1}{8}$ to $\frac{1}{4}$ inch (3.17–6.35 Mm.) thick, very long, cylindrical, longitudinally wrinkled, externally grayish- or orange-brown; internally showing a whitish and mealy or somewhat horny cortical layer surrounding a circular wood-zone enclosing a broad pith; nearly inodorous; taste mucilaginous, bitterish, and acrid. The thick, woody, knotty rhizome, if present, should be removed.

Sarsaparilla contains an active principle, *parillin*, an acrid glucoside which froths with water and otherwise closely resembles saponin in its action.

Dose.—30–60 grains (2.0–4.0 Gm.).

Official Preparations.

Decŏctum Sarsaparĭllæ Compŏsitum—Decŏcti Sarsaparĭllæ Compŏsiti—Compound Decoction of Sarsaparilla.—*Dose*, 4–6 fluidounces (118.–178. Cc.). 10 per cent., with Sassafras, Guaiac-wood, Glycyrrhiza, and Mezereum.

Extrăctum Sarsaparĭllæ Flūidum—Extrăcti Sarsaparĭllæ Flūidi—Fluid Extract of Sarsaparilla.—*Dose*, $\frac{1}{2}$–2 fluidrachms (2.0–8.0 Cc.).

Extrăctum Sarsaparĭllæ Flūidum Compŏsitum—Extrăcti Sarsaparĭllæ Flūidi Compŏsiti—Compound Fluid Extract of Sarsaparilla.—*Dose*, $\frac{1}{2}$–2 fluidrachms (2.0–8.0 Cc.).

Sўrupus Sarsaparĭllæ Compŏsitus—Sўrupi Sarsaparĭllæ Compŏsiti—Compound Syrup of Sarsaparilla.—*Dose*, 2–4 fluidrachms (8.0–16.0 Cc.). A Fluid Extract, 20 per cent., with the Fluid Extracts of Glycyrrhiza and Senna, and the Oils of Sassafras, Anise, and Gaultheria.

Antagonists and Incompatibles.—Alkalies and free iodine are incompatible with the official preparations of sarsaparilla. Corrosive sublimate is said to be changed into calomel by the compound syrup of sarsaparilla.

Synergists.—The specifics, diaphoretics, and diuretics.

Physiological Action.—Sarsaparilla has no local influence.

Internally its action is similar to that of guaiac, though not so energetic and irritant in large doses.

Therapeutics.—As with guaiac, the history of sarsaparilla is full of interest. Introduced into Europe in the sixteenth century by the Spaniards, who had learned of its alleged virtues in constitutional *syphilis* in Peru, San Domingo, and Brazil, it retained its reputation as a specific in this disease for a century or more, when it was abandoned, only to be revived at the close of the eighteenth century. Since that time it has retained its place in medicine more through the wonderful virtues ascribed to it by nostrum-venders than to any real medicinal properties which it possesses.

The consensus of competent opinion seems to be that sarsaparilla can claim no special medicinal virtues other than its diuretic and diaphoretic properties.

The compound decoction of sarsaparilla is probably the most useful official preparation, and appears to have been of some benefit in *scrofula* and *strumous cutaneous affections*. Indeed, some cases of *constitutional syphilis* have improved more rapidly under the administration of this preparation than when mercury or potassium iodide has been given alone.

Contraindications.—There are none.

Administration.—No special directions can be given for the administration of the various preparations. The compound syrup of sarsaparilla is quite pleasant to the taste, and is used extensively as a vehicle, particularly for potassium iodide.

Stillĭngia—Stillĭngiæ—Stillingia. *U. S. P.*

(Queen's Root.)

Origin.—The root of *Stillingia sylvatica* L., a perennial herb growing in dry and sandy soil in the Southern United States as far north as Eastern Virginia.

Description and Properties.—About 1 foot (30 Cm.) long and nearly 2 inches (5 Cm.) thick, subcylindrical, slightly branched, compact, wrinkled, tough, grayish-brown, breaking with a fibrous fracture, showing a thick bark and porous wood, inner bark and medullary rays having numerous yellowish-brown resin-cells. The odor is peculiar and unpleasant; the taste bitter, acrid, and pungent.

The fresh root probably contains an active principle not yet determined. (Old roots are nearly inert.) It contains an acrid

resin, *sylvacrol*, a volatile and a fixed oil, resin, starch, gum, and tannin.

Dose.—15–30 grains (1.0–2.0 Gm.).

Official Preparation.

Extractum Stillingiæ Fluidum—Extracti Stillingiæ Fluidi—Fluid Extract of Stillingia.—*Dose*, ¼–1 fluidrachm (1.0–4.0 Cc.).

Unofficial Preparations.

Decoctum Stillingiæ—Decocti Stillingiæ—Decoction of Stillingia.—*Dose*, 1–2 fluidounces (30–60 Cc.).

Extractum Stillingiæ Fluidum Compositum—Extracti Stillingiæ Fluidi Compositi—Compound Fluid Extract of Stillingia.—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.). Stillingia, 130; Corydalis, 130; Chimaphila, 60; Iris, 60; Sambucus, 60; Xanthoxylum Berries, 30; and Coriander, 30; to make 500 parts Fluid Extract with Dilute Alcohol.

Syrupus Stillingiæ Compositus—Syrupi Stillingiæ Compositi—Compound Syrup of Stillingia.—*Dose*, 1 fluidrachm to 1 ounce (4.0–30 Cc.). Compound Fluid Extract, 1, to Simple Syrup, 3 parts.

Tinctura Stillingiæ—Tinctura Stillingiæ—Tincture of Stillingia.—*Dose*, ½–1 fluidrachm (2.0–4.0 Cc.).

Antagonists and Incompatibles.—There are none affecting Stillingia.

Synergists.—The same as for sarsaparilla.

Physiological Action.—The action of stillingia resembles that of sarsaparilla, the drug increasing the various secretions and stimulating the heart and circulation.

Therapeutics.—The medical uses are the same as those of sarsaparilla.

Sanguinaria—Sanguinariæ—Sanguinaria. *U. S. P.*

(Blood-root.)

Origin.—The rhizome of *Sanguinaria Canadensis* L., a low perennial, a native of Canada and the United States, where it grows in open woods in a rich soil. The rhizome should be collected in autumn.

Description and Properties.—Of horizontal growth, about 2 inches (5 Cm.) long and ⅖ inch (1 Cm.) thick, cylindrical, somewhat branched, slightly annulate, wrinkled, reddish-brown; fracture short, somewhat waxy, whitish, with numerous small red resin-cells, or of a nearly uniform, brownish-red color; bark thin; odor slight; taste persistently bitter and acrid. It contains a color-

less alkaloid, *sanguinarine*, yielding red salts; chelerythine, yie ing lemon-yellow salts; homochelidonine; and protopine.

Dose.—2–20 grains (0.12–1.2 Gm.).

Official Preparations.

Extractum Sanguinariæ Fluidum—Extracti Sanguinariæ Fluidi—Fl Extract of Sanguinaria.—*Dose*, 5–15 minims (0.3–1.0 Cc.).

Tinctura Sanguinariæ (15 per cent.)—**Tinctūræ Sanguinariæ—Tinctur Sanguinaria.**—*Dose*, 10–60 minims (0.6–4.0 Cc.).

Unofficial Preparations.

Acetum Sanguinariæ—Acēti Sanguinariæ—Vinegar of Sanguinaria.—*Do* 15–40 minims (1.0–2.5 Cc.); as an emetic, 1–4 fluidrachms (4.0–16.0 Cc.).

Sanguinarine Nitrate.—*Dose*, $\frac{1}{12}$–$\frac{1}{6}$ grain (0.005–0.008 Gm.).

Antagonists and Incompatibles.—The irritation and circu latory depression occasioned by blood-root are antagonized by opium, atropine, etc., while the incompatibles are tannic and gall acids, alkalies, and metallic salts.

Synergists.—The Specifics and the mineral and vegetable emetics aid the action of sanguinaria.

Physiological Action.—*Externally and Locally.*—Sanguinari is an irritant and a feeble escharotic. When the powder of blood root is inhaled it produces great irritation of the respiratory pas sages, with excessive secretion and violent sneezing.

Internally.—Digestive System.—Medicinal doses occasion sense of constriction in the throat and heat in the epigastrium increasing the secretions from the stomach, liver, and intestines Excessive doses are followed by marked salivation, nausea, and vomiting, the drug acting as a systemic emetic. Very large dose cause great irritation of the intestines, producing hypercatharsis.

Circulatory System.—At first the heart's action is increased and arterial tension raised, but these effects are followed by cardiac and circulatory depression. Poisonous doses sometimes result in car diac paralysis.

Nervous System.—Large doses diminish reflex excitability paralysis of the spinal centers, occasionally producing convulsio of spinal origin.

Respiratory System.—Medicinal doses of sanguinaria have apparent effect upon the respiration; poisonous doses, howe render the breathing slow and shallow, death resulting from phyxia due to paralysis of the respiratory center. The final

lapse is often preceded by convulsions arising from the accumulation of carbon dioxide in the blood from failure of respiration.

Blood-root is a stimulant expectorant, increasing the secretion from the broncho-pulmonary mucous membrane.

Absorption and Elimination.—The drug is quite rapidly absorbed, and is eliminated by the intestines, stomach, skin, kidneys, and bronchial mucous membrane.

Temperature.—Medicinal doses have no effect upon, but excessive doses lower, the temperature.

Eye.—Poisonous doses produce dilatation of the pupils.

Uterus.—Sanguinaria possesses emmenagogue properties.

Untoward Action.—This does not differ from the poisonous action which follows.

Poisoning.—Blood-root is an acro-narcotic poison, exciting salivation, violent vomiting, profuse watery evacuations from the bowels, and producing all the symptoms of gastro-enteritis. The muscular system is greatly relaxed, the pulse is slow, weak, and irregular, the skin covered with cold sweat, and finally collapse of the vital powers supervenes. Convulsions may precede a fatal termination, which is due to paralysis of the respiratory or cardiac center.

Treatment of Poisoning.—The stomach should be washed out and diffusible stimulants freely given. Strychnine may be administered hypodermically, and digitalis and amyl nitrite given if necessary. The pain and nausea may be relieved by morphine and atropine. The normal temperature of the body should be maintained by external warmth.

Therapeutics.—*Externally and Locally.*—The nitrate of sanguinarine—$\frac{1}{4}$ grain (0.015 Gm.) to 1 ounce (30 Cc.) of glycerin—has been recommended by Keyser in *conjunctivitis granulosa.* The powdered blood-root has been employed as a sternutatory, and when mixed with two or three times the amount of powdered acacia or starch it has proved beneficial, in the hands of some physicians, in the dry form of *atrophic rhinitis.* The pure powder is said to be an efficient escharotic to *nasal polypi* and *fungoid conditions of the mucous membrane.* Some authorities claim it to be an effective remedy for *cancer,* and consider it a valuable stimulant for indolent *ulcers.*

The decoction of sanguinaria has been employed as a gargle in *scarlatinal angina.*

This drug is now seldom used locally, the irritation caused by

it being so great that patients can only with great difficulty be persuaded to submit to the treatment.

Internally.—While possessing alterative properties and classed among the Specifics, one of the principal uses of sanguinaria is in *acute bronchitis*, when the spasmodic element predominates and after the subsidence of the more acute symptoms.

In atonic conditions of the *stomach* and *bowels*, with increased secretion of mucus, small doses of tincture of sanguinaria prove beneficial. The tincture is of equal value in *duodenal catarrh* with jaundice.

As an emmenagogue and aphrodisiac blood-root has been successfully employed in *functional amenorrhea* and *dysmenorrhea*, as well as in functional *impotence* with *relaxation* of the *genital organs* and daily *seminal losses.*

Sanguinarine has been recommended in *hysteria*, either alone or associated with podophyllum.

Protracted *muscular rheumatism* has apparently been benefited by this drug.

Tincture of sanguinaria has served as an emetic in *spasmodic laryngitis*, though its depressing and irritating action renders sanguinaria much less desirable than certain other emetics.

The drug is considered to possess marked alterative properties, and is still frequently employed in the treatment of *syphilitic* and *strumous affections* of a chronic nature.

It certainly appears to be a mild stimulant to the vegetative system of nerves, improving the circulation, nutrition, and secretion.

Contraindications.—No special contraindication exists, unless it be an acute inflammatory condition of the stomach and bowels.

Administration.—The nitrate of sanguinarine is the best preparation to use in diseases of the respiratory tract. As a gargle the vinegar of sanguinaria is to be preferred, while, if the drug is to be employed as an emetic, the infusion, given in tablespoonful doses at short intervals, serves the best purpose. For other purposes the tincture is the most desirable preparation.

The sanguinarine nitrate is best administered in pill form; the liquid preparations should be given well diluted with water.

Mezerēum—Mezerēi—Mezereon.—*U. S. P.*

Origin.—The bark of *Daphne Mezereum* L. and other species of Daphne, small shrubs about 2–4 feet (0.6–1.2 M.) high, indige-

nous in hilly and mountainous regions of Europe, extending to the Arctic Circle and eastward to Siberia.

Description and Properties.—Long, thin bands, usually folded or rolled into disks, the outer surface yellowish or brownish-yellow, with transverse scars and minute blackish dots, underneath of a light greenish color; inner surface whitish, silky. Bast in transverse layers, very tough; inodorous; taste very acrid. The important constituent is an acrid resin, *mezerin;* it also contains a crystalline glucoside, *daphnin.*

Dose.—1–5 grains (0.06–0.3 Gm.).

Official Preparation.

Extractum Mezerei Fluidum—Extracti Mezerei Fluidi—Fluid Extract of Mezereon.—*Dose,* 1–5 minims (0.06–0.3 Cc.). Mezereon is also one of the ingredients in Decoctum Sarsaparillæ Compositum, Extractum Sarsaparillæ Fluidum Compositum, and Linimentum Sinapis Compositum.

Antagonists and Incompatibles.—The glucoside is precipitated by tannic and free acids, and the resin by water, in which it is insoluble.

Synergists.—All the vegetable specifics, with the exception of colchicum.

Physiological Action.—Its action, both locally and internally, is quite similar to that of sanguinaria, but when applied to the skin it is more of a vesicant than an escharotic, and taken internally it is more of a diuretic than sanguinaria, in poisonous doses causing severe urinary irritation and other symptoms produced by a violent gastro-intestinal irritant. The treatment of poisoning would be the same as that prescribed under poisoning by sanguinaria.

Therapeutics.—It is a counter-irritant in the form of an ointment. Internally it is now seldom if ever used alone, but in combination with other vegetable specifics it is prescribed in *chronic rheumatism* and in *chronic syphilitic* and *non-syphilitic cutaneous diseases.*

Contraindications.—Acute inflammation of the stomach, bowels, and kidneys.

Administration.—As it is never given internally alone, no special instructions for its administration are necessary. The fluid extract freely diluted with water would, however, be the only preparation to use.

Xanthŏxylum—Xanthŏxyli—Xanthoxylum. *U. S. P.*

(Prickly Ash.)

Origin.—The bark of *Xanthoxylum Americanum* Miller and of *Xanthoxylum Clava-Herculis* L. Both species are native to North America, the first being shrubby and attaining a height of 10 or 12 feet (3–3.6 M.), while the second species is a small tree sometimes 30 or 40 feet (9–12 M.) high.

Description and Properties.—*Xanthoxylum Americanum* (Northern Prickly Ash) occurs in curved or quilled fragments about $\frac{1}{25}$ inch (1 Mm.) thick; outer surface brownish-gray, with whitish patches and minute black dots, slightly furrowed, with some brown, glossy, straight, two-edged spines, linear at the base and about $\frac{1}{4}$ inch (6 Mm.) long; inner surface whitish, smooth; fracture short, non-fibrous, green in the outer and yellowish in the inner layer; inodorous; taste bitterish, very pungent. *Xanthoxylum Clava-Herculis* (Southern Prickly Ash) resembles the preceding, but is about $\frac{1}{12}$ inch (2 Mm.) thick, and is marked by many conical, corky projections, sometimes $\frac{4}{5}$ inch (2 Cm.) high, and by stout brown spines rising from a corky base.

Xanthoxylum should not be confounded with the bark of *Aralia spinosa* L., which is nearly smooth externally, and beset with slender prickles in transverse rows.

Prickly ash contains an acrid green oil, a colorless, crystalline resin, a bitter principle, sugar, ash, and tannic acid.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparation.

Extractum Xanthŏxyli Fluidum—Extracti Xanthŏxyli Fluidi—Fluid Extract of Xanthoxylum.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Physiological Action.—The action of xanthoxylum is quite similar to that of sanguinaria, though it is more of a stomachic tonic, sialagogue, diuretic, and diaphoretic, and not so much of a local irritant. It increases the heart's action and raises arterial tension.

Therapeutics.—It is used locally as a masticatory for the same purposes as mezereon, and the decoction has been highly recommended as a gargle in *chronic pharyngitis*.

Internally its medical uses are the same as those of stillingia, mezereon, etc., although of more value in *atonic dyspepsia*.

Contraindications and **Administration** are the same as for sanguinaria.

Serum-therapy.

Among the marvels of scientific research which have distinguished our century no achievements are more remarkable, nor of greater moment to the welfare of mankind, than those pertaining to the field of biological, pathological, and therapeutic investigation. Yet, brilliant as have hitherto been the triumphs of speculative thought and the deductions drawn from tireless experimentation and practically applied to the curative art, the highest generalizations and most signal exhibitions of genius are perhaps related to the special phenomena revealed by the study of zymotic diseases. The limits of the present work preclude a detailed treatment of so extensive and complicated a subject; yet a brief summary, elucidating the theory and development of serum-therapy as exemplified in contemporaneous research, should be of interest as well as benefit to the student of modern therapeutics.

A glance at the history of therapeutic procedure in the prophylactic treatment of infectious diseases shows that the general principle underlying all later discoveries was, however crudely, divined at a much earlier period than we are wont to suppose. In view of actual attainment it is natural that the mind should revert to the transcendent services rendered to mankind by Jenner; yet it is known that the ancient Hindus and Persians, as well as the nomad tribes and caravans of Farther Asia, practised inoculation of equine virus, or *horse-pox*—the mammary pustule developed during early lactation in the horse, camel, and cow, and even in woman.

The inoculation of human virus is of immemorial origin, probably coeval with the importation of variola from Asia into Africa by the Saracens. Certain it is that as early as the tenth century the Arabs and Chinese adopted the custom of variolization, the inoculation of small-pox, although the skeptical physicians of the age consigned the practice as a monopoly to women.

In 1717, Lady Montague, wife of the British ambassador at Constantinople, saw an old Thessalian woman whose immunity so impressed her that she practised the operation upon her own child. Writing from Adrianople, she says: "They take the small-pox here for diversion; I have tried it on my dear little son; I am going to bring this useful invention into fashion in England." In

1718 her desire was realized, King George II. adopting the practice in the royal family. Three years later the custom was introduced in France, being accepted by Chirac and Helvetius, although the decrees of the Sorbonne and the Faculty of Medicine condemned the innovation as "illicite et contraire à la loi de Dieu;" notwithstanding which official malediction the practice of inoculation continued to spread until supplanted by vaccination proper in 1800. The French peasants knew in the last century that the act of milking cows infected with mammary pustule, where there was any lesion of the epidermis on the hands, conferred immunity against small-pox; and the mountaineers have long been accustomed to collect the crusts resulting from vaccine disease, macerating them in water, and inoculating their children with the solution.

The success attending these rude experiments in France was communicated by a Frenchman, Rabault, in 1768, to Dr. Pew, an English physician, who reported the matter to his friend Jenner, who at once perceived the momentous import of the discovery. Meanwhile, in 1771, a Holstein schoolmaster vaccinated three pupils; and in 1774 an English farmer, having observed the protection existing among his dairymaids, and having implicit confidence in the efficacy derived from inoculation of bovine virus, vaccinated his wife.

It was reserved for Jenner, however, in 1776, to commence the systematic and exhaustive study of the subject destined to prove inestimably beneficial to mankind. It was, in truth, the year celebrated for his declaration of scientific independence, which, after long contumely and scurrilous ridicule, was to wrest from his humiliated adversaries every weapon of derision and reproach.

His early experiments were but a repetition of the empirical yet prophetic test of the English farmer; yet with his gifted insight and indomitable courage the field of discovery was greatly amplified, the results being in accordance with scientific methods inspired by Jenner's originality and force.

He found in the northern counties of England a certain form of ulcer upon the hands of those employed in dairies and immune against small-pox; observed that the malady resembled the pustules affecting the udder of the cow, having apparently been occasioned by contact; vaccinated an individual supposed to be unprotected against the disease, and subsequently exposed him to infection with triumphant impunity. A long interval of laborious investigation had led to this final test, and it was not until 1798

that Jenner published his first paper upon the subject, vaccination being transported to America in the following year.

Such is the brief yet eloquent record of an achievement which experience has proved to be of incalculable benefit to man. To-day there is no question among the more enlightened members of the profession that the operation, *properly performed*, is an absolute safeguard against the infection of small-pox.

Strange indeed is it that a century of comparative quiescence should have elapsed since Jenner pointed the way to the startling accomplishment of the present epoch. Yet not until Pasteur, in 1880, announced to the world the issue of his labors touching the protective inoculation of animals was the broken thread of pathogenic research taken up anew, and the task of solving its mysteries resumed—be it said with profounder acumen and far more complete appliances than ever before.

It is a matter of record how the French savant demonstrated that cultures of the bacilli of chicken-cholera, when thoroughly dried and long exposed to the air, lost their virulence, and that fowls inoculated with the attenuated virus were rendered insensible to the attacks of more energetic micro-organisms. It was, *mutatis mutandis*, a modification or development of the Jennerian principle: "The history of vaccination constitutes the first step in a long series of labors inspired by the admirable discoveries originating in the genius of Pasteur. The principle is always the same—to diminish the strength of the virus and inject it into the animal which we wish to render immune" (Bernheim). Yet in the far-reaching possibilities suggested by Pasteur's experiments the present was immeasurably in advance of previous attainment.

The further application of this discovery to other animal infections confirmed by indisputable evidence the validity of the savant's theories and the efficacy of their practical illustration. A new light was shed upon pathogenic study; all Europe felt the impulse given to scientific thought in its relation to therapeutic progress, and in the sanctum of the laboratory many a fervent recluse sought to amplify the knowledge already attained.

A striking departure from Pasteur's method by Salmon and Smith, in 1886–87, led indirectly to the latest evolution of inoculative therapy. They showed conclusively that animals may be rendered immune against certain infectious diseases by inoculating them with filtered cultures containing the toxic products of pathogenic micro-organisms entirely free from the living bacteria to

which they owe their origin. By this process immunity against the bacillus of hog-cholera was attained in pigeons, the disease being almost invariably fatal to these birds. A little later (1888) Roux, employing similar sterilized cultures, succeeded in protecting susceptible animals against the anthrax bacillus; and more recently (1890) Behring and Kitasato have proved that immunity against the action of the tetanus bacillus may be conferred by the use of toxic products in solution freed from the presence of active germs—in a word, that *purely chemical agents* sufficed to attain the object hitherto deemed wholly dependent upon the influence of living bacteria. The significance of this discovery could hardly be over-estimated. By it the entire theory of causal phenomena—the protective force in which the immunizing property was supposed to reside—became modified. If not a living organism, but a chemical substance, proved to be the immunizing agent, then resistance to toxic influences must proceed from some source other than bacterial metabolism, some organic force inherent in the inoculated system. To ascertain the nature and operation of this bactericidal power and determine the *rationale* of acquired immunity now engaged the earnest attention of savants throughout the world.

It was soon found that the lymph and blood of a normally healthy organism possessed in a degree this mysterious property of neutralizing the toxic effects of bacterial action, and gradually the truth which had thus far eluded the most searching investigation was revealed. Finally, by a series of experiments involving the rarest skill and discrimination, the resistant energy developed by the infected organism was traced to certain albuminoids pertaining to or dissolved in the blood-serum, the acute and comprehensive insight of Behring, especially, sustaining the new hypothesis, which speedily passed from the realm of conjecture to the assurance of experimental proof, culminating in the establishment of *serum-therapy* as a legitimate and auspicious field of therapeutic science. It should be observed that the remarkable discoveries of Koch in his chosen domain of bacteriology had exercised no little influence in guiding and confirming the wider researches of his successors.

Before entering upon a consideration of practical details it should be stated that the theory and practice of serum-therapy are based upon the condition of the system, whether in man or the lower animals, which renders it inhibitive of bacterial development by opposing an effective barrier to the propagation of pathogenic germs. This self-protective antagonism pertaining to the indi-

vidual organism is termed *immunity*, and may be either *natural* or *acquired*.

By natural immunity is understood the absence of all personal predisposition toward certain infections or diseases, even under the most favorable exposure. A familiar example of this inherent, congenital unsusceptibility is found in poisoning by various species of *Rhus*, some persons handling the plants and even chewing the leaves with impunity, while upon others the mere proximity of the poison has a toxic effect.

Acquired immunity may be either *accidental* or *artificial*. In the former case protection is secured by a previous access of the disease—as, for instance, a child recovered from scarlet fever, who is rarely prone to a second attack. In the latter case the susceptibility is obviated by protective inoculation, it being known, to illustrate, that an animal inoculated by injections of anthrax-poison is, after recovery from transient symptoms of disease, rendered artificially immune—a fact demonstrated by the thoroughly scientific experiments of Pasteur.

An eminent authority, Schleich, has declared that natural or spontaneous immunity does not exist, but that the protective quality is created by the animal kingdom—either through a previous malady or, as more frequently happens, through transmission from progenitors to offspring. Syphilis or tuberculosis in parents, he maintains, confers upon children immunity from these diseases; and the author cites in support of his theory that certain infections, such as plague and leprosy, have wholly disappeared from various countries because of the inoculation of succeeding generations and the consequent attenuation of the virus—exhaustion of the soil, as it were. Bernheim asserts that no animal is endowed with absolute immunity, but that, however strong may be the resistance of the particular organism, it must succumb to an excessive invasion of microbes or of toxic products.

The doctrine of immunity has, not inaptly, been styled the theorem of which serum-therapy is the logical corollary; yet it is only within a few years that the mystery which shrouded the entire subject has been dispelled. To-day, thanks to untiring researches in the fields of physiology, biology, and chemistry, we are acquainted, if not with its precise nature and origin, at least with many details intimately associated with its causation. Formerly supposed to be absolute in its relation to species and individuals, we now recognize that immunity is but relative, considerations of

climate, race, receptivity, character of pathogenic germs, and conditions of infection all entering as modifying factors into the development and exercise of this potent yet complex force.

Chauveau has shown that Algerian sheep, relatively immune against anthrax, contract the disease under enormous hypodermic injections of culture; on the other hand, a slight puncture of the aural epidermis is fatal to sheep in France, which, transported to Algeria, succumb to natural infection. Watson-Cheyne states that a single virulent bacillus may cause the death of a guinea-pig or induce septicemia in the mouse, provided these animals be peculiarly susceptible. Yet the guinea-pig is not affected by the injection of a few bacilli from a septicemic mouse, while several thousands occasion only an abscess, although death ensues with higher dosage. Again, young white mice are quickly killed by the anthrax bacillus, while the same injection produces in the old only a local lesion. Cattle, though more amenable to infectious disease than sheep, are but slightly affected by hypodermic injections. Hogs are but slightly sensitive to anthrax, while the immunity of carnivora is proverbial. Meat infected with anthrax is innocuous to the dog, the cat, and the fox.

Again, anthrax has but little influence upon birds or fowls, especially chickens, yet it has proved fatal to sparrows and pigeons; and Pasteur overcame the immunity of chickens by plunging their feet in water, heat and cold, according to M. Roger, predisposing animals to infection, less by moderating bodily temperature than by disturbing the general economy and diminishing the power of resistance.

As with anthrax, so in the case of glanders, peculiar to horses —the varying susceptibility to infectious diseases is apparent, bovine animals being wholly immune, and the hog, dog, singing-birds, and pigeons but slightly affected.

In tuberculosis experimental injection of the same culture is followed by results widely diverse, certain animals being seized with acute tuberculosis, while others show marked resistance to the poison, although under excessive doses none is completely immune. In this connection it may be noted that clinical experience demonstrates the same pathological diversity in human beings. The goat, dog, ass, and sheep are rarely affected by tuberculous disease, yet all are susceptible to pathogenic inoculation. The monkey, seldom contracting the disease in his native haunts, becomes upon transportation remarkably prone to phthisical affections. With the

exception of the dog, most of the carnivora are easily influenced by tuberculous contagion. On the other hand, cold-blooded animals are singularly immune, inoculation of toxic germs producing no development of the disease, though fatal results may occur from systemic intoxication.

These examples, which might be multiplied indefinitely, suffice to show the *relative* character of natural immunity. It may be added that the caprice of toxic infection becomes even more apparent in studying the physiological and pathological conditions of the same organism when subject to the modifying influences of climate, altitude, seasons, heat, cold, traumatism, diet, ventilation, etc., and the subjective considerations of age, sex, race, fatigue, splenetic influence, nervous lesions, alcoholism, auto-intoxication, and acquired or hereditary diathesis. Indeed, the pathological records of disease abound in curious, often inexplicable, data touching individual and racial immunity. The subject is important in its bearing upon serum-therapy, and furnishes a theme of profitable study in its relation to the practical treatment of infectious disease.

With regard to the *rationale* of immunity, the theories advanced in explanation of this occult yet indubitable force are many, and often greatly at variance. Eliminating those which may be regarded as too fantastic for serious consideration, the more plausible conjectures refer the phenomena in question to *cellular*, *chemical*, *chemico-cellular*, and *vaso-motor* agencies.

Prominent among competent opinions is the doctrine of *phagocytosis* proposed by Metschnikoff.

In 1883 Metschnikoff established the existence of an intracellular digestion, showing that nomad cells were capable of absorbing vegetable filaments; that mesodermic protoplasm possessed the same power over bacteria; and that in the higher animals this phagocytic function had its analogue in the digestive property of *leucocytes*, or white blood-corpuscles. Glüge observed that in hemorrhage of the nervous centers these corpuscles digest the disintegrated myelin, and in a fresh-water crustacean, daphne, they have been seen to gather about the spores of algæ, penetrating the mesoderm.

Metschnikoff multiplied these examples of cellular defence among invertebrates, distinguishing two sorts of leucocytes: the stationary (macrophages) and the mobile (microphages), the latter including the white globules of lymph, and especially of blood, of

which, together, they constitute about 20 per cent. It may be said that all organs contain elements of defence—macrophages.

The experiments of Gabritschevsky, who has studied phagocytosis in diphtheria, are highly instructive. Injecting a pure culture of Loeffler's bacillus into the anterior chamber of a rabbit's eye, he saw the devastation wrought among the leucocytes, which appeared powerless to contend against the deadly germs. But after immunizing the rabbit with attenuated cultures previous to the injection of toxic bacilli, a battle-royal ensued, the phagocytic action of the leucocytes resulting in the signal triumph of the latter, so that at the end of eight hours not a single free bacillus was found in the chamber, all having been absorbed within the opposing globules.

Yet, notwithstanding the plausibility of Metschnikoff's hypothesis and the striking significance of his experiments—embracing in epitome the whole theory of preventive inoculation—certain arguments of Behring and Kitasato, based upon experimental research, go far to disprove the validity of the doctrine he so zealously maintained. Still, although the substances which form the defensive property of phagocytes, and are so fatal to the pathogenic action of microbes, remain unknown to us, the fact of phagocytosis cannot be denied.

It was natural in the light of new developments that investigation should inquire whether the leucocytes constituted the only protective force within the organism. Then followed the theory that the humors in general possess microbicidal power—either through the presence of destructive elements and the secretion of soluble toxins or through the chemical capacity of withdrawing oxygen from the invading micro-organisms. To Buchner is chiefly due the early elucidation of the chemical *theory*, and of first recognizing in *serum* bactericidal properties, he being followed by Behring, to whom is to be credited the more important labor of extending experimentation and proving that animals naturally immune against a certain disease may furnish serum endued with neutralizing power. Behring found that the blood and blood-serum of the rat, which is naturally immune against anthrax, possesses strong bactericidal properties, while those of mice, cattle, etc., very susceptible to anthrax infection, have none.

Further research resulted in Behring's all-important law, established by searching experiment, that "the blood and blood-serum of an individual which has been rendered *artificially* immune against a certain infectious disease may be transferred into another

individual, with the effect of rendering the latter also immune, no matter how susceptible this animal is to the disease in question." This formulated doctrine became the fundamental motive in all future investigations, the culminating achievement of inoculative therapy being the announcement of Behring and Kitasato in 1890 concerning the artificial immunity against tetanus and diphtheria conferred by blood-serum, including the first emphatic declaration that the power of rabbits and mice when rendered immune to resist tetanus-poisoning "is based upon the ability of blood-serum to neutralize the toxins produced by the tetanus bacilli." As Krieger well observes: "These toxins are the poisonous products of bacterial metabolism, and are the causes of acute disease when circulating in the organism. Their effect is an *intoxication* of the system, while after the introduction of virulent germs the cause of the disease is an *infection*."

An antitoxin is not the direct result of bacterial action, but is properly described as an unknown body resulting from the resistance of a healthy organism to the toxins of pathogenic bacteria. In practice this antitoxic body comes to us in the blood-serum of animals, usually the horse. When properly prepared and properly kept in aseptic containers the antitoxins are not at all dangerous—in fact, are as innocuous as an equal amount of blood-serum or normal salt solution administered in the same way. We use antitoxins to resist the effects of infection with pathogenic bacteria because the results of such infection are due to the toxins elaborated by those bacteria, and not to the bacteria themselves. These antitoxins do not destroy the bacteria; in other words, they are not germicides. In fact, the antitoxic serums are themselves good culture-media. One theory of their action is that they neutralize the toxin, thus giving the natural bactericidal powers of the body an opportunity to exercise their function.

In support of the proposition that the symptoms in infectious diseases are due to the toxins elaborated by the bacteria, and not to the bacteria themselves, the following quotation from the last edition of Sternberg's *Manual of Bacteriology* is given: "Certain saprophytic bacteria, when injected beneath the skin of a susceptible animal, multiply at the point of inoculation and invade the surrounding tissues, giving rise in some instances to the formation of a local abscess, in others to an infiltration of the tissues with bloody serum, and in others to extensive necrotic changes. These local changes are due not simply to the mechanical presence of the

micro-organisms which induce them, but to chemical products evolved during the growth of these pathogenic bacteria. Indeed, their pathogenic power evidently depends, in some instances at least, upon these toxic products of their growth, by which the vital resisting power of the tissues is overcome. Other bacteria, while they develop chiefly in the vicinity of the point of entrance—by accident or by inoculation—produce a potent toxic substance which gives rise to general symptoms of a serious character, such as tetanic convulsions (bacillus of tetanus), or intense fever and nervous phenomena (micrococcus of erysipelas). The pus cocci and various other saprophytic bacteria when introduced beneath the skin give rise to the inflammation of abscesses, unattended by any very considerable general disturbance, and also to secondary purulent accumulations—metastatic abscesses.

"That this is not due simply to their mechanical presence is shown by the fact that powdered glass and other inert substances, when thoroughly sterilized, do not give rise to pus-formation when introduced beneath the skin or when injected into the cavity of the abdomen. On the other hand, it has been demonstrated by the experiments of Grawitz, De Bary, and others that certain chemical substances which act as local irritants when brought in contact with the tissues may induce pus-formation quite independently of micro-organisms; nitrate of silver, oil of turpentine, and strong liquor ammoniæ have been shown to possess this power. And it has been demonstrated by the recent experiments of Buchner that sterilized cultures of a long list of different bacteria—seventeen species tested—give rise to suppuration when introduced into the subcutaneous tissues.

"In diphtheritic inflammation of mucous membranes we have a local invasion of the tissues and a characteristic plastic exudation. In true diphtheria the local inflammation and necrotic changes in the invaded tissues are not sufficient to account for the serious general symptoms, and we now have experimental evidence that the diphtheria bacillus produces a very potent toxic substance, to which these symptoms are no doubt largely due. The diphtheria bacillus of Löffler appears to be the cause of the fatal malady which goes by this name, but undoubtedly other micro-organisms may be concerned in the formation of diphtheritic false membrane."

In addition to this valuable information afforded us by Dr. Sternberg, additional evidence as to the correctness of this conclusion is the fact that horses while being immunized give the classical

constitutional symptoms of each disease, though they are treated with the filtered toxin, which contains no bacteria whatever. A possible exception may be made of anthrax, though Sternberg distinctly states that it acts in the same way.

As to the therapeutic action of antitoxin, little or nothing is known positively; it seems reasonable to conclude from experimental evidence that the antitoxin neutralizes the toxin in the body and thereby gives the natural germicidal powers an opportunity to dispose of the bacteria. It may be that it has the additional property of stimulating the phagocytic and possibly other bactericidal functions. The following experiments made by Messrs. Martin and Cherry in England, and described in an editorial in the *Journal of the American Medical Association* of August 27, 1898, will be of interest in this connection. Behring, Ehrlich, and Kanthack have advocated the theory that the antagonism between toxins and antitoxins is a chemic one, somewhat analogous to the neutralization of an acid by an alkali; while Buchner, Metchnikoff, and others have maintained that it is indirect and operates through the cells of the organism. Martin and Cherry used a snake venom antitoxin. A considerable number of guinea-pigs were used. At 68° C. the antitoxin was destroyed, while the venom retained its virulence. In the control-experiment with the venom only, all the animals died within a few hours. A number of mixtures were made of 1 Cc. of antitoxin with twice the fatal dose of venom; others with three or four times the fatal dose. These mixtures were allowed to stand at the usual laboratory temperature (20° to 23° C.) for two, five, ten, fifteen, and thirty minutes respectively, then heated to 68° C. and then injected.

As remarked above, this heat destroyed the antitoxin, so that none was injected. The animals subjected to the mixture of the stronger doses of 10 minutes or less died, or were seriously affected; all of those receiving the 15-minute mixtures survived; while the 30-minute mixtures produced no symptoms whatever. Similar results were obtained with diphtheria antitoxin and toxin. These experiments seem to show, as far as anything can, that neutralization of toxins may occur in the test-tube, and that the vital processes in the organism and the body-cells are not essential. These gentlemen made further experiments by passing a mixture of toxin and antitoxins through a film of gelatin in a Pasteur-Chamberlain filter. This was porous for toxin, but not for antitoxin, owing to the difference in the size of their molecules. The toxin which

passed through the filter, after having been mixed with antitoxin, was neutral. The unavoidable conclusion from this experiment is that the toxin was neutralized before filtration.

Further tests were made to prove their theory that toxins are albumoses and antitoxins globulins; but their experiments do not appear to be conclusive.

The supposition that the administration of antitoxin is followed by a stimulation of the germicidal powers of the body seems to be reasonable, at least in the case of the antistreptococcic serum, since the streptococci disappear with the passing away of the signs and symptoms. On the other hand, the Klebs-Löffler bacillus is found in the throat for weeks or even months after the disappearance of all symptoms of diphtheria in cases treated with the antitoxin.

Doubtless the immunizing property of serum was divined by those who adopted free venesection in cachectic patients, abstracting the vitiated blood and replacing it with venous injection of that supplied by a healthy organism. A certain antagonism had also been observed between infectious maladies mutually opposed in their development, one of which was prone to exert a curative action upon the other. Fehleisen in 1880 cited the phenomenal case of a woman afflicted with cancer of the breast, which after three successive operations still redeveloped rapidly. Finally erysipelas attacked the cicatricial wound of the amputated breast, the new malady proving beneficial to the patient, since carcinoma was not renewed. From this and similar data Emmerich inferred that it sufficed to inject the serum of animals immunized with the streptococcus of Fehleisen to treat and cure (?) cancerous subjects, the toxins of streptococcus erysipelatis preventing carcinomatous and sarcomatous development.

Having purposely dwelt at some length upon the evolution and general properties of serum-therapy, let us turn to the actual achievement of the method in its therapeutic relations to infectious disease. In view of well-authenticated and obvious records attesting the efficacy of the new treatment, the charge "not proven" cannot properly be sustained. Yet the observation of Achalme, that it is well to accept new theories *salis cum grano*, is not inapplicable; and the wise admonition of Bacon in regard to books, that we should read "not to accept nor refute, but to weigh and consider," is equally apposite in estimating the value of scientific discoveries, however distinguished may be their claim to recognition.

Tetanus.—The first proof that tetanus is an infectious disease, of bacillary origin, was furnished by Carle and Rattone, who in 1884 reproduced the symptoms in a rabbit by inoculation of pus taken from a human tetanus wound. The bacilli were found in the adjacent soil, but it was not until 1889 that Kitasato succeeded in isolating pure cultures, proving conclusively the microbic nature of the disease.

The earliest case treated with antitoxin was reported in 1891 by a Bolognese physician, Dr. Gagliardi, the result being highly satisfactory. In the light of subsequent experiments it is of absorbing interest. The patient, a man forty-five years of age, accidentally received a wound of the left foot while crossing a rice-field. Next day (May 12, 1891), the foot having swollen considerably, he consulted Dr. Gagliardi, who made an incision and applied antiseptics. May 19th the wound was healed, but four days later symptoms of trismus appeared, becoming acute May 24th. Injections of 5 per cent. carbolic acid in the vicinity of the wound produced no effect, and on June 3d opisthotonos and aggravated symptoms were manifested. The doctor now injected 0.25 c.cm. of Tizzoni's antitoxin, obtained from a strongly immunized dog, the treatment being followed by some improvement. June 7th, relapse and tetanic spasms having supervened, two more injections were administered, and the following day the patient gradually convalesced, being discharged as cured July 5th. The quantity of antitoxin sufficient to neutralize the tetanus-poison was less than 1 c.cm. In 1891–92 four other cases were treated with like favorable results, injections of 0.25 c.cm. twice a day, from two to six doses in all, being attended with complete recovery. When it is taken into consideration that the most authentic statistics of tetanus show a mortality of about 88 per cent., and that by the above procedure it was reduced to 20 per cent., it is small wonder that the issue in these cases should be regarded as simply marvellous. And yet we have, after devious wanderings, reached but the threshold of the new science.

In December, 1890, Behring and Kitasato demonstrated that the serum of animals rendered immune against tetanus by the injection of iodine trichloride in the blood was capable of neutralizing tetanic poison, whether in the laboratory or in other animals, the property not being possessed by organisms not inoculated. Not only did they succeed in preventing infection, but they recognized in the serum a curative power, as shown in the inoculation

and cure of mice. At the same time it was observed by Vaillard that the immunity conferred by the serum was of short duration, lasting only fifteen days.

Kitasato's preventive injection—a mixture of living culture and gradually decreasing doses of iodine trichloride—was perfected by Behring, who successfully applied it to the mouse, rabbit, sheep, and horse. Various results of experimental research ensued, eliciting among other interesting phenomena the fact that removal of the spleen renders immunization impossible. In 1891, Vaillard showed that the serum of animals naturally immune is not antitoxic, becoming so only after a powerful dose of tetanic poison, and that the spleen and the fluids of immunized subjects are devoid of antitoxic properties.

One point in the doctrine advanced by Behring and Kitasato awakened the liveliest discussion: whether it was possible to *cure* disease by the serum of inoculated individuals. Tizzoni and Cattani had failed to attain this result, and had, moreover, recognized that the condition of immunity was transient. On the other hand, Behring had claimed the cure of tetanus in the sheep and horse, and Kitasato had obtained results equally positive in the case of mice.

All doubt on this head was dissipated by Ehrlich in 1891, who proved by experiments with ricin and abrin that the antitoxic and immunizing property of serum varies greatly with the degree of immunity conferred. In seeking a favorable issue it was evident that in cases of failure the inoculation had fallen short of the degree requisite to render the serum curative.

It should be added that in subsequent treatment Tizzoni, Cattani, and Vaillard met with perfect success in effecting cures.

Thus far, the employment of serum as a curative agent had been confined to experiments upon animals. The results obtained urged its application to human tetanus. The first attempt was made by Kitasato in 1891, the serum being taken from a rabbit. It was unsuccessful, the dose of serum employed being too feeble to cope with the gravity of the conditions presented. In 1892, Tizzoni and Cattani and others reported 8 cures with serum from immunized dogs. It was contended, however, that a comparatively mild form of the disease was treated. In France the results of similar treatment in 1892 were wholly unfavorable, but in 1893 the cure of a peculiarly aggravated case was authentically announced, amelioration of symptoms having occurred in three, and complete

restoration in twenty, days. The injection was subcutaneous in the abdominal region, 300 c.cm. of equine serum from an immunized animal being given. The injections are said to be in themselves harmless.

Finally, MM. Roux and Vaillard formulated the mode of preparation of antitetanic serum, together with an analysis of its properties and its curative application in man and the lower animals.

It may reasonably be expected that future experiments with the antitoxin of tetanus, made with greater precision and untiring patience, will produce more favorable results.

It is of primary importance to consider, first, whether sufficient amounts of immunizing serum are injected to combat the conditions of this most difficult disease, and, second, whether the doses are renewed often enough to arrest its progress or ensure immunity. These desiderata are sufficiently obvious, especially in view of the certainty that the antitoxin is wholly innocuous.

It is to be regretted that tetanus antitoxin does not in clinical use do all that it will do in the laboratory. It has been used in a considerable number of cases, but in nearly every instance without any result that would justify us regarding it as a great curative agent. However, it should be used early in every case of tetanus and in large doses, because it is, like the other serums, harmless, and the patient has a somewhat better chance for recovery. Not until our means of diagnosis have been improved by bacteriological methods or otherwise can we expect great results from the tetanus antitoxin. The following explanation for the inefficacy of this antitoxin has at least the merits of some plausibility and originality on the part of its author. The toxin of the bacillus tetanus has a chemical affinity for nerve-tissue and enters into chemical combination with and destroys such tissue; and it is this chemical combination and destruction in the nerve-centers which produce the tetanic convulsions. The antitoxin has no such chemical affinity, and neutralizes only that toxin remaining in the blood-current, and, of course, it cannot repair the nerve-tissue lesion. When we are able to diagnose tetanus early the antitoxin will be used successfully. One or two cases have been successfully treated with intracerebral injections of antitoxin, the theory being that the antitoxin should be placed where it could neutralize the toxin which is producing the convulsions by means of its action on the nerve-centers. The value of this method of administration has not been proven. Fully as many cases have been treated unsuccessfully.

As a preventive measure, the tetanus antitoxin is all that can be desired. Dr. Joseph Hughes, one of the most eminent and conservative veterinary surgeons in Chicago, says that he has used the tetanus antitoxin as a prophylactic in over five hundred cases following wounds both surgical and accidental. Not one has developed the disease, though he has used it where he was justified by former experience in expecting tetanus to show itself. Dr. Hughes uses 10 Cc. as a protective dose, and injects it five to seven days after the suspected inoculation.

Diphtheria.—It is in the treatment of this universal and terrible disease that serum-therapy has achieved its most signal triumphs, the marvels wrought by its influence attracting more and more the attention both of the medical profession and of the laity.

The micro-organism of the malady was described by Klebs in 1883, his investigations being quickly followed by those of Loeffler, who confirmed Klebs' discovery and announced that it was possible not only to isolate, but also to produce, cultures of the microbe. Roux and Yersin, as well as other savants, have established the fact that the germ is found only in the false membrane—especially its surface—and in the saliva or contiguous mucous membrane, *never* developing in the circulating fluid either of the lymph or any other portion of the organism.

The bacillus frequenting the false membrane is rarely unaccompanied, but is found associated with other micro-organisms which exert great influence upon the progress of the disease. It propagates rapidly upon solidified serum, bouillon, and gelatin, though not on potato, preserving its virulence for several months. In direct contact with light and air it perishes within a few weeks.

The false membrane is artificially formed by painting with pure culture the buccal ulcers of the mucous membrane in rabbits, dogs, guinea-pigs, and chickens, the symptoms produced being those of human diphtheria, and frequently fatal. The researches of Loeffler indicate that no direct action is attributable to the bacillus, the systemic effects of the poison being rather those of a general intoxication of unknown nature—an opinion sustained by the researches of Roux and Yersin. The microbe may be ejected by the mouth together with the false membrane, but oftener it remains in an isolated state ensconced in buccal and nasal cavities, perhaps for several days or even weeks.

Although the discovery of the pathogenic micro-organism of diphtheria is of quite recent date, no time has been lost in seeking

to determine the means of conferring immunity against the disease. To Behring (1889) is due the credit of having first indicated the method of immunization in the disease, as well as in tetanus, his investigations leading him to affirm that the process of conferring immunity by the soluble products of Loeffler's bacillus derived from immunized animals, combined with a solution of iodine trichloride, is positively innocuous and curative in diphtheria.

Little progress was made by the experiments of earlier investigators, but, in 1891, Aronson succeeded in immunizing rabbits against diphtheria by inoculation with cultures attenuated by the vapor of formaldehyde. The serum obtained possessed great immunizing power, a single cubic centimeter sufficing to inoculate 4 kilograms of animal weight against the minimum mortal dose of virulent cultures.

Subsequently, Aronson applied this therapeutic method to numerous children affected with diphtheria, and affirmed with Behring that serum-therapy was inoffensive and a sovereign remedy in a large number of cases. He obtained the serum from dogs and sheep, but declared that large animals were preferable, especially the horse.

In order to formulate the dosage, Behring established a technical scale in which *one cubic centimeter* of prepared serum is considered a *unit*, the antitoxin supplied being of the strength of 60, 150, or 500 units according to the degree of immunity of the animal from which it is derived. The value of serum depends, he affirms, upon the difference between the original condition of, and the refractory state attained by, the animal under immunization.

Notwithstanding the significance attaching to experiments hitherto recorded, the thereapeutic application of serum-therapy to diphtheria may be said to date from the communication of Roux to the Congress of Buda-Pesth (September, 1894). From this moment clinical observations multiplied and statistics were reported from all parts of the world.

In this memorable address the author ably reviewed the entire subject of serum-therapy, stating the relations of serum to the general economy and offering advanced and cogent suggestions concerning the employment of antitoxins to arrest the ravages of infectious disease. The early failures to cure tetanus were explained by the fact that the symptoms of the disease are frequently not manifested until it is too late to stay its progress. On the other hand, in diphtheria the evident appearance of the characteristic

false membrane rendered it possible to treat the malady from its inception. The most approved, though complicated, methods of preparing the toxin were minutely described—either through the medium of bouillon as a host in contact with dry air, or a similar process in a current of moist air—and explicit instructions given regarding the attenuation of the poison by means of iodine, and the *modus operandi* of administration in gradually intensified doses.

"With regard to diphtheria associated with certain microbes," said M. Roux, "especially streptococcus, the results of serotherapy have been far from satisfactory. I have often saved rabbits treated six or eight hours after tracheal infection, although repeated injections of therapeutic serum were necessary: when treatment has been deferred twelve hours, the animals have invariably succumbed.

"The efficacy of antidiphtheritic serum having been established experimentally, its application to the human malady was a natural consequence. All my experience occurred at the Hospital for Sick Children in conjunction with MM. Martin and Chaillou. From the 1st of February to the 24th of July, 1894, 448 children were admitted to the diphtheritic ward, of whom 109 died—a mortality of 24.33 per cent. Now, the average mortality from 1890 to 1895 was 51.71 per cent. in a total of 3971 children. The advantage of serum-therapy, all conditions being equal, is 27.28 per cent. greater than under the former treatment.

"Such are the gross statistics. It is necessary, however, to deduct from the foregoing 448 patients treated with serum 128 who, as the bacterial examination showed, were not affected with true diphtheria of the Klebs-Loeffler bacillus type, besides 20 desperate cases amenable to no possible treatment. The net statement, therefore, is 300 cases with 78 deaths—a mortality of 26 per cent., whereas a previous report, similarly computed, recorded a mortality of 50 per cent."

M. Roux is quoted at length because his views are authoritative, embodying the most careful researches connected with serum-therapy in its application to diphtheria. With regard to the relative proportion of deaths, it is instructive to compare with his figures those of more recent investigators and medical practitioners.

At an international Congress held in Munich in April, 1895, the merits of serum-therapy in diphtheria formed the subject of an interesting debate, eliciting reports from the most competent

Continental authorities in which the efficacy of the new treatment was strikingly demonstrated.

Dr. O. Heubner of the University of Berlin, comparing the statistics of the Berlin hospitals during 1894, stated that the mortality since the introduction of serum-therapy had been reduced to one-half of that recorded prior to that date, about 1500 cases being included in each period. Allowing for the condition of medium virulence which marked the disease, Prof. Heubner believed that this factor alone could not account for the great difference in the mortality. Up to the present time, he said, reliable information of over 3000 cases had been obtained from all parts of the world in which the disease was treated with antitoxin serum. The average of cures was 80 per cent. Referring to clinical analysis of 300 cases of diphtheria coming under his own supervision, he declared that the disease could be diagnosed only by identification of the diphtheria bacilli. Of 207 cases so diagnosed and treated in the Berlin Charité, the mortality in simple attacks was 10 per cent., and in more complicated ones 13 per cent. From personal experience the speaker regarded, as the specific results of serum-treatment, the improvement in the febrile symptoms and the quickened cleansing of the air-passages—facts first noted since the introduction of serum-therapy, and confirmed wherever the method was adopted.

Prof. A. Baginsky of Berlin said that prior to the introduction of the treatment with serum the more difficult and sorrowful portion of his life had been spent in combating the disease, against which he felt absolutely helpless, the mortality for the past four years, in spite of every effort, having been 50, 33, 36, and 42 per cent. respectively. The deaths occurring under treatment of 525 cases with Dr. Aronson's preparation had been 15 per cent.

Prof. von Widerhofer of Vienna stated that in 300 cases of diphtheria coming under his observation the average mortality was 23.7 per cent. Excluding those that died within twenty-four hours, the disease having reached a very advanced stage previous to treatment, the mortality falls to 14.3 per cent.

Prof. von Ranke of Munich reported that of 124 cases treated in the six months previous, 26 children, or 22.4 per cent., died, 102 cases presenting features of uncomplicated diphtheria. Compared with the mortality during the preceding eight years, the reduction was enormous, being less than half the minimum record for any year during that period.

Prof. von Mehring reported on 74 cases, all treated with serum on the first or second day, of which only 4 died, giving a mortality of 5 per cent. During the preceding five years 30 per cent. of his diphtheria patients had died.

Prof. von Noorden gave the results of his experience in 81 cases treated at the Frankfort Hospital. Most of them, unfortunately, were admitted at a late stage of the disease, generally on the third or fourth day, the severest symptoms being developed. Notwithstanding this obstacle, in place of the previous mortality of 45 per cent., only 23 per cent. was recorded.

Authorities.	Locality.	Cases treated with serum.	Mortality in per cent.	Previous mortality in per cent.
Vierordt	Heidelberg	55	14.6	58.0
Ganghofner	Prague	110	12.7	50.0
Viederhofer	Vienna	100	25.3	42.8
Kossel	Berlin	350	16.7	34.7
Baginsky (quoted by Virchow)	Berlin	303	13.2	47.8
Sonnenburg	Berlin	107	20.6	27.6
Aronson	Berlin	190	14.0	37.0
Ranke	Munich	85	18.8	48.5
Soltmann	Leipsic	122	18.0	
Risel	Halle	114	8.0	
Roux, Martin, and Chaillou	Paris	300	26.0	51.7
Lebreton	Paris	258	12.0	
Moizard	Paris	231	14.7	50.0
Washbourn, Goodall, Card, and others	London	195	18.6	31.1
White	New York	32	25.0	42.7
Withington	Boston	80	16.0	45.0
Total number of cases		2632		
Average mortality, per cent.			16.8	
Previous average mortality, per cent.				42.0
Collective report of other observers in different countries		4022	17.1	

Dr. G. Seiz of Constance stated that of 27 cases treated with serum he lost only 1, or 3.3 per cent.

Prof. Sigel, in charge of the Olga Hospital at Stuttgart, reported that the general mortality for the five years previous to 1894 was 40.1 per cent., and 60 per cent. among those upon whom tracheotomy was performed in the first nine months of 1894—in fact, up to the day on which the antitoxin treatment was commenced—the mortality rising to 50.3 and 70 per cent. respectively. During the three months of serum treatment in 1894 there was an astonishing decrease in the number of deaths, the mortality falling to 12 per cent. in general and 20.3 per cent. in tracheotomy cases.

The reports, emanating from authorities of the highest standing, were of themselves conclusive testimony in favor of serum-therapy in diphtheria as immensely superior to former methods of treatment.

An interesting résumé of statistics, compiled from the library of the Royal College of Surgeons, England, by Dr. G. C. Crandall of St. Louis, Mo., emphasizes in comprehensive figures the explicit advance made within a few years in the scientific control of the disease. The table on page 296 embodies the results of Dr. Crandall's timely study of the subject.

The official report from the Imperial German Health Department up to June 20, 1895, records 2228 cases, with a percentage of mortality of 17.3; and further German statistics (August 10, 1895) include 10,240 cases in hospitals and private practice, 5790 of which were treated with antitoxin serum, the number of deaths being 552—a mortality of 9.5 per cent.

Prof. Eulenburg, the author of this report, reiterated the importance of early recourse to antitoxin, stating that when used within the first forty-eight hours the mortality was only 4.2 per cent.: delayed beyond this period, the percentage was increased to 16.8.

In America the merits of serum-therapy have been amply attested by reports from various sections of the country, one of the most recent and instructive being that of the resident physician of the South Department of the Boston City Hospital, as follows:

"In the Boston City Hospital, from Feb. 1, 1894, to Jan. 31, 1895, before antitoxin was used, 698 cases of diphtheria were treated, with 266 deaths—a mortality of 38.1 per cent. Since the opening of the South Department, from Sept. 1 to Nov. 30, 1895, inclusive, when antitoxin was used in every case, 332 cases were treated, with 41 deaths—a percentage of 12.3. Of these 41 deaths, 23 occurred within twenty-four hours of entrance. Eliminating these, there were 309 cases with 18 deaths—a mortality of 5.8 per cent."

Finally, the statement of Prof. Welch of Johns Hopkins University, published in July and August, 1895, contains statistics of 7166 cases of diphtheria treated with antitoxin, in which the mortality was 17.0 per cent., and 2276 cases treated otherwise with a death-rate of 42 per cent.

The foregoing figures, selected from a mass of corroborative testimony, must certainly be regarded as an eloquent tribute to the virtues of serum-therapy. They are at least a striking illustration

of what Virchow has called the "brute force" of the numerical argument.

Touching the method of administration and collateral manifestations, Roux, in the communication previously cited, says:

"The serum I have employed, derived from immunized horses, had an active strength of 50,000 to 100,000. To all diphtheritic patients entering the hospital 20 cubic centimeters of this serum, in a single dose, are systematically administered, the injection being in the subcutaneous tissue, and not renewed should bacteriological examination prove that the disease was other than diphtheria. Should the existence of the disease be fully established, I have never observed the slightest discomfort resulting from the dose.

"The injection is painless, and if made antiseptically should be attended with no accident. Twenty-four hours after the first injection a second is made of 10 or 20 cubic centimeters, these two inoculations sufficing, as a rule, to ensure recovery.

"Should the temperature continue high, a third injection of 10 or 20 cubic centimeters is given. The average weight of children being 14 kilograms, the total dose constitutes one-thousandth, or in exceptional cases one-hundredth, part of their weight. Untoward sequelæ are less frequent under the use of serum, although I have observed symptoms of paralysis. Eruptions, also, allied to urticaria may be occasioned by the antitoxin.

"The physiological effect of the serum is apparent in its action upon the false membrane, which ceases to develop within twenty-four hours after the first injection, being detached after twenty-six, forty-eight, or, at most, sixty hours. In 7 cases only have I known it to persist longer. Let me add, in conclusion, that in treatment with serum I have studiously avoided the use of local applications, simply irrigating the throat with boiled water, to which was added perhaps 50 grams (per liter) of Labarraque's solution."

In commenting upon the address of M. Roux, Dr. Behring added that "the specific action of antidiphtheritic serum is the surer and more rapid in proportion to the heroic nature of the dose. Since the injection is positively harmless, it may be adopted with impunity even in simply suspected cases of the disease."

The prophylactic property of equine serum is well attested by Aronson, who employed antidiphtheritic injections to immunize children in families where the disease was established. One cubic centimeter of prepared serum sufficed for his purpose, of 130 chil-

dren thus treated preventively only 2 being affected with a very mild form of the disease.

It is impossible, says Bernheim, to assign a definite duration to the antitoxic property of serum. It may last several weeks, or even months, according to the strength of the injection and the species of animal under treatment. But, he adds, when definite immunity has been attained the protective power of serum may be prolonged by the injection of a small quantity of toxin every fourteen days.

Concerning the various untoward complications arising from the use of serum and authentically reported, it is fair to say that the same phenomena are observed in diphtheritic patients treated by other methods than serum-therapy.

Notwithstanding the eminent success of the method herein considered, it should be said, in conclusion, that several important features are as yet but imperfectly formulated or even understood.[1] It is of paramount interest to ascertain, for example, the precise prophylactic power of the immunizing serum. Behring has already directed his attention to this problem, advising the injection of 5 cubic centimeters of serum in children under ten years of age, and 10 cubic centimeters in older patients. Crouzon, who has practised these preventive injections in 230 cases, reports but two light attacks of the disease. A similar experience is that of Baginsky in Berlin. Bernheim asserts that he has personally injected serum in 28 subjects exposed to diphtheritic infection without noting a single case of the malady. The dose employed was somewhat in excess of that proposed by Behring, being from 10 to 20 cubic centimeters, as recommended by Hilbert, the injection being twice repeated at intervals of twenty days.

From a careful consideration of the subject in its relations to diphtheria, we may safely conclude—

[1] In a paper upon the subject "Antitoxin," Prof. A. C. Cotton, M. D., of Rush Medical College, Chicago, puts the case thus strongly:

"What we do not know is how much antitoxin exactly is necessary to neutralize a given quantity of toxin at somewhat lengthened periods precedent. What we do not know, and what we most particularly desire to know, inasmuch as it is about the only phase of the entire subject that has any practical bearing upon our profession as life-savers, is what number of antitoxin units is necessary to neutralize an indefinite amount of diphtheria toxin of unknown virulence that has invaded at a prior indefinite time, and is presumably hourly continuing to invade, in unknown strength and quantity, from a patch of recurrent and extending culture of Klebs-Loeffler bacillus on an unknown extent of mucous surface of a human being of unknown susceptibility."—*The Corpuscle*, Dec., 1895.

1st. That immunized serum forms a remedy which experience proves to be wholly innocuous and eminently adapted for use in human infection.

2d. That antidiphtheritic serum has in every respect corresponded with the most sanguine hopes of its advocates, its employment being attended with astonishing success wherever properly used and in sufficient quantities.

3d. Finally, that it is incontrovertibly established that by means of injecting serum temporary immunity from infection may be readily conferred, permanent protection being contingent merely upon a renewal of treatment.

The present status of diphtheria antitoxin may be presented in a few words. It has established itself as a specific in the treatment of this disease. During the past year the use of larger doses has become more general, and it seems certain that better results are obtained. The administrators of the Chicago Department of Health give 2000 units in all cases of suspected diphtheria, and employ 1000 units as an immunizing dose. During the months of November and December this department treated 219 cases of bacteriologically proven diphtheria, all charity cases, with a death-rate of 4.1 per cent. Some two and a half years ago, when antitoxin was not used, the death-rate from diphtheria treated by this department was about 35 per cent.

A considerable number of reports have been published showing good results from the use of diphtheria antitoxin in other diseases, as asthma, acute bronchitis, etc. Its favorable action in these conditions cannot be satisfactorily explained. Dr. McClintock says that possibly the natural immunity of the horse against these diseases will account for the favorable action of his blood-serum in these diseases. In other words, Dr. McClintock thinks its therapeutic action in these conditions is due to the blood-serum, and not to the diphtheria antitoxic body present in the serum.

Tuberculosis.—It may be stated, in general terms, that the microbic nature of tuberculosis was admitted by nearly all writers upon the subject before the discovery of the pathogenic microorganism. Villemin in 1866 had established by experiment the infectious character of the malady; but in France the idea seemed almost revolutionary, creating no enthusiasm, it being reserved for C the indefatigable labors of Robert Koch, to : the theory conceived by Villemin. Koch : of tuberculosis, and even succeeded in iso-

lating and cultivating it, the pure cultures obtained by him always producing tuberculosis in every form. His original communication, addressed to the Physiological Society of Berlin, bore date of April 10, 1882, and at once stimulated experimental research in others, who fully confirmed his discovery.

The tubercle bacillus is aërobic and facultative anaërobic, a fact readily explaining its predilection for pulmonary tissue. The bacillus may effect all warm-blooded animals, although in different degrees, the microbe being somewhat differentiated in the lesions of birds and those of man and the mammalia in general.

Spontaneous tuberculosis is extremely frequent in man, it being estimated that one-fifth of all fatalities are due to phthisis in its various forms. It is also common among cattle, in which the progress of the disease and its lesions are markedly similar to those observed in human beings—a fact demonstrated by the admirable studies of Koch respecting pulmonary lesions and their characteristic pathogenic micro-organisms.

Like other microbes, the bacillus tuberculosis produces a large amount of soluble products. These toxins, which of late years have been subjected to careful experiment, are derived from cultures of human bacilli, modified or not by aviary germs and the tuberculous products produced in the organism itself. Koch's tuberculin, now known throughout the world, is simply a soluble product, prepared by a special process, consisting of a glycerized extract drawn from pure cultures of tubercle bacillus, its activity depending upon the virulence of the germs, those derived from man being more dangerous than aviary cultures.

Various methods of inoculation have been adopted in tuberculosis: 1, inoculating the patient with another disease; 2, inoculation with attenuated tuberculosis or that proceeding from a different species, as from birds; 3, inoculation of the soluble bacillar products—tuberculin; 4, injection of blood taken from animals often immune against tuberculosis; 5, injection of serum drawn from inoculated animals; 6, finally, injection of serum taken from immunized animals. With the last two of these methods we are properly concerned. The fifth has been scientifically adopted by Babès, Richard, and Héricourt, who have treated a large number of cases in which various cures have been effected. The main obstacle of the procedure lies in the difficulty of successful inoculation, the greater part of the animals employed dying of infectious nephritis.

By the sixth method, as employed by Bernheim, this fatality is largely obviated, a careful procedure with the serum of immunized animals proving the most efficacious hitherto devised. The process of immunizing consists in injecting the toxic products normally secreted by Koch's bacillus, and is, in effect, that adopted by Behring in preparing the antitoxin of diphtheria. In experimenting upon a large number of animals, suffice it to say that the results obtained by Bernheim were eminently satisfactory, every case indicating improvement and the actual cures being about 40 per cent. So convinced was he of the sovereign value of his method that he emphatically declared it to be the only rational procedure possible in tuberculosis.

The discovery by Koch of the bacillus tuberculosis revolutionized the generally accepted theory of tubercular disease, and with his further announced discovery of the antitoxin of the germ great expectations were raised touching the possibility of conquering the dread malady. It soon developed, however, that Koch's claim was premature, and although able and diligent workers have labored constantly to attain the desired end, it must be admitted that thus far they have met with doubtful success. In 1888 Hericourt and Richel succeeded in transferring immunity to tuberculosis from dogs to rabbits by means of serum injections. For several years Drs. E. L. Trudeau and E. R. Baldwin have carried on a series of interesting experiments designed to secure immunity from the disease. The results are as follows:

1. A sheep was injected intravenously with killed thymus cultures. The result was so unsatisfactory that the serum-tests were not conclusive.

2. Chickens were inoculated intraperitoneally with mammalian tuberculosis. The serum revealed no germicidal nor inhibitive action on the tubercle bacilli, nor favorable influence on the course of the disease in guinea-pigs.

3. A sheep was injected with tuberculin. The serum was wanting in germicidal, antitoxic, or curative effect, so far as tested.

4. A sheep was inoculated intravenously with non-virulent cultures. Cachexia followed, and the serum was therefore not used.

5. An ass was inoculated as in 4; it died from pulmonary embolism. The serum was not bactericidal to tubercle bacilli.

6. An ass was inoculated with virulent tubercle bacilli and treated with tuberculin. The serum showed no germicidal nor curative but possibly some antitoxic, effect.

7. An ass was inoculated with non-virulent tubercle bacilli and treated with various extracts of tubercle bacilli and dead bacilli. The serum showed no activity.

8. Rabbits were inoculated with non-virulent and virulent tubercle bacilli, and recovered. Their serum possibly conferred some protection in tuberculin-poisoning, and possibly prolonged the lives of treated guinea-pigs.

It is especially noteworthy that in the above experiments the serums were powerless to prevent local or general reaction from small doses of tuberculin, nor to influence the temperature in tuberculous animals. On the whole, the outlook may be regarded as far from encouraging in our present knowledge of antitoxins. It is impossible to conjecture, however, what future investigations may reveal.

The future for this serum in the treatment of chronic phthisis is bright with hope. We are told that in the majority of cases simple, uncomplicated tuberculosis of the lungs is not a dangerous disease; that it is the added infections, such as streptococci, staphylococci, the yeast-fungus, and others, that kill. Dr. Robert Reyburn of Washington, D.C., makes the statement that the vast majority of persons over sixty years of age who die from any cause have had tubercular deposits in their lungs. The fact that complications in the post-mortem examinations in public hospitals and in other public institutions show tubercular lesions in the majority of subjects indicates that tuberculosis in the lungs is usually a self-limited disease. Of these the most frequent and probably the most important are the streptococci. In the few cases where the anti-streptococcic serum has been used the reports have been almost uniformly favorable. However, its value is not by any means demonstrated.

The anti-tubercle serum has not proved itself of more value than a great number of other remedies vaunted as a specific in this disease. Maragliano of Italy continues to send encouraging reports, and has recently erected a tuberculosis hospital in or near Rome, where his antitoxin is to be used. It must be confessed, though regretfully, that this serum has not been a marked success in this country.

Pneumonia.—Fibrinous, croupous, or lobar pneumonia is an acute infectious form of the disease, usually occasioned by the diplococcus pneumoniæ, and affecting an entire lobe, or perhaps more, of one or both lungs.

The diplococcus pneumoniæ (Fränkel-Weichselbaun) most frequently occurs in the sputa and lungs, and appears to be unquestionably the cause of the malady, although occasionally other micro-organisms seem to cause typical fibrinous pneumonia, as, for instance, the pneumococcus of Friedländer, streptococcus, staphylococcus, typhoid bacillus, the bacillus of influenza, and the bacillus coli communis. In fact, a number of various germs may cause the disease, the result of mixed infection. The fibrinous form of pneumonia occurring in tuberculosis is without doubt a secondary infection, as is the case in typhoid fever and influenza, the particular bacilli of which may cause pneumonia.

The germs above mentioned usually reach the lungs through the bronchi, the diplococcus pneumoniæ being frequently found in the mouth and upper respiratory passages, indicating one source of infection. In rare instances the germs may be inhaled, or may gain access to the lungs through the circulation.

The pneumococcus does not confine its attacks to man, the rabbit and guinea-pig being especially sensitive to its influence. It has been observed that the microbe is a frequent prey to leucocytosis. It thrives in a total absence of oxygen, its vitality and virulence, so far from diminishing, being sensibly increased by anaërobic conditions. Pure cultures are easily obtainable.

Repeated inoculations of attenuated virus readily confer immunity, reduction of virulent germs being attained by the use of desiccated pneumonic viscera. The saliva of a patient, collected after defervescence, ensures protection to the mouse, the same being true of blood-serum. Immunization of animals was inaugurated by Emmerich and Fovitsky in 1891, subsequent investigators confirming their experiments under varying conditions, Foa and Scabia finally employing human serum in the inoculation of rabbits with marked success.

It had been supposed that the spleen was the seat of an immunizing product possessing greater activity, but a glycerized extract of human spleen injected into the veins of refractory rabbits failed to arrest death. The general deduction drawn from a careful scrutiny of the subject tends to prove that the production of the neutralizing force in the system—the antipneumotoxin—is shared by all the elements of the organism, including the spleen.

The therapeutic interest of the subject centers in the application of inoculation to man. The early experiments of Foa and Scabia were without result, neither reaction nor amelioration attending

their treatment; but in 1892, Klemperer reported favorably concerning immunization in 40 cases of human pneumonia.

In January, 1893, Lava communicated to the Academy of Medicine in Turin the application of serum-therapy with auspicious results. He inoculated 10 subjects—5 with from 4 to 9 cubic centimeters of rabbit's blood-serum; 4 with a like dose of glycerized extract of the viscera of immunized rabbits; and 1 with from 4 to 5 cubic centimeters of canine serum. There is no reaction at the point of inoculation, no general disturbance of the system, nor any influence upon temperature or respiration. On the contrary, the pulse is favorably influenced, as is also the general progress, as shown by Lava's experiments. Moreover, the injection hastens the crisis of the disease, conducing rapidly to complete restoration.

Rozzolo also reported 5 cases treated with serum, 4 of which were cured. No influence upon the pulse, heart, or kidneys was noted.

The effect of animal serum is fugacious; that of the human product lasts several days. In all cases the serum of immunized subjects possesses a therapeutic but not an antitoxic power. It does not diminish the virulence of pneumococci, which, injected in an inoculated organism, retain their pathogenic activity about eighteen hours, after which, indeed, their vitality is manifested by the production of toxins producing positive chemotaxis in the phagocytes.

Among other curative methods in pneumonia may be cited the hypodermic injection of blood taken from convalescents and the infusion of blood from similar patients. The former resulted favorably (Audeoud), and the latter (Hughes of Philadelphia), an intravenous operation, was no less successful.

Audeoud explains the natural crisis in pneumonia by the theory of Klemperer—that the antipneumotoxin formed in the blood of an inoculated subject by neutralizing the pneumotoxin cures the infection.

Cholera.—The microbe of this terrible disease had been sought since 1848, yet the subject had never been profoundly studied until Koch succeeded in isolating the germ. Being associated with other micro-organisms, the bacillus had remained undetected, being distinguishable, in fact, only in fulminant attacks of the disease, as was noted by Strauss and Roux.

Stagnant water is particularly favorable to the propagation of germs. In distilled water the bacillus survives but twelve hours;

in drinking-water, seven days (Babès); while in river or well-water it may live for seven months (Wolfhügel). As a rule, the acids are injurious to the bacilli, bichloride of mercury, sulphate of copper, and quinine being very powerful antiseptics in presence of the germs.

Cholera has been observed in man alone, though Koch imparted the disease to guinea-pigs, to which it was fatal. One physician in Weichselbaum's laboratory contracted the disease from cultures. The pathogenic power of the bacillus is well demonstrated by the fact that in one of the Berlin hospitals, of 207 patients attacked by cholera nostras (cholerine) in which no germ was manifest, but one case proved fatal; and, notwithstanding vigorous opposition, Koch's original thesis appears to be sustained by observation.

A singular fact in connection with cholera germs is that they may be ingested at times, if not with impunity, at least without inducing the disease. Pettenkofer, having taken large doses of alkali, absorbed a considerable quantity of the poison with only the effect of a diarrhea during five days, there being no disturbance of the general system or of the kidneys. Emmerich, ingesting the tenth part of Pettenkofer's dose, was seized with diarrhea twenty-four hours afterward, and became seriously ill. Purging lasted four days, and on the eleventh day the bacilli disappeared from the stools.

It were beside the purpose of the present work to relate in detail the many interesting experiments upon animals undertaken with a view to the application of serum-therapy in the treatment of human cholera. Although the experimental investigations of recent years foreshadow the possibility of immunization in man, it must be confessed that, as in the case of tuberculosis, they have been thus far barren of definite results. It is announced that Behring has discovered a practical method of combating the disease: until the results of his later researches are known the therapeutic problem must apparently remain unsolved. The results of Haffkin's investigation in India were awaited with interest, but they have not proved satisfactory.

Septicemia.—The streptococcus of Fehleisen (erysipelatis), which causes erysipelas, was discovered by Nepveu in France and Hüter in Germany (1868–80), and has been the subject of careful study by Klemperer and others in the hope of determining its availability as an immunizing agent. Employing the serum of immunized rabbits, it has been found possible by intravenous injec-

tion to cure the disease in mice, the serum proving efficacious only against the disease with which the animal supplying it was inoculated. Subsequent experiments have been attended with varying results, Marmorek in February, 1895, having succeeded in obtaining a germ of streptococcus so virulent that the hypodermic injection of $\frac{1}{100000}$ of a cubic centimeter was fatal to the rabbit in thirty hours. Inoculation with this microbe or its toxins conferred immunity upon rabbits, which furnished a preventive and curative serum.

Encouraged by previous experimentation, Charrin and Roget now sought to apply the method of serum-therapy in the treatment of puerperal fever. Having satisfied themselves of the curative property of the serum of a mule inoculated with the microbe of erysipelas, collected fifteen days after the eighth inoculation, they injected subcutaneously 8 cubic centimeters of serum in a woman affected with the fever. The report is as follows: "The next day no improvement. A second injection of 8 cubic centimeters. Next day condition slightly improved, but still serious. Third injection of 25 cubic centimeters. Result on the following day rapid improvement; decline of fever; general good health; and early establishment of convalescence."

Anti-streptococcic serum gives promise of being second only to the diphtheria antitoxin in point of therapeutic value. It has been most successful in erysipelas and puerperal septicemia. Cases of scarlet fever are reported where it has been useful in shortening the duration of the disease and in preventing unfortunate complications and sequelæ, such as otitis media and other suppurative processes due to streptococci.

A valuable contribution to the literature on this antitoxin was made by Dr. W. A. Baum of Chicago, and published in the January number of *Medicine*. A perusal of this essay will repay any one interested in the antitoxin treatment of disease. Dr. Baum reports twenty-two cases coming under his observation in which the serum was used. "Of these, nineteen were cases of erysipelas; one of erysipelas plus tubercular nuchal glands, and one of erysipelas with puerperal septicemia and double labial abscess. The last was the only fatal case. In four of the cases of erysipelas only one injection of the serum (10 Cc.) was used, with a reduction of temperature to the normal within twenty-four hours; no relapse. In six others four injections of 10 cubic centimeters each were given upon consecutive days, with a rapid recovery on the fifth day; no

relapse. In three the injections were followed by a reduction in temperature within twenty-four hours, but relapse at intervals of from three to six days. In all of these cases the serum was again used. In one, repeated injections seemed to exercise no effect upon the temperature, and the treatment was followed by sponging, which seemed more effective. The others were old cases in which there had been a marked tendency to relapse; in these not only was the temperature reduced, but the cases showed rapid improvement and recovery.

"During this time many other cases of erysipelas were under treatment at the hospital, but an effort was made to select those cases which were characterized by high temperature or complications."

Dr. Baum also speaks of Baginsky's report of results in forty-eight cases of scarlatina in which antistreptococcic serum was employed. In twenty-seven the course of the disease was unusually favorable, the majority recovering without complications. A striking feature in all was the rapid reduction of temperature. In exceptional cases albumin appeared, and a single case had nephritis with tube-casts and blood-corpuscles. In a second group of cases of a severe type the results were not so favorable, although it is possible that in these the amount of serum employed was insufficient. Among the whole number of cases there were seven deaths, or 14.6 per cent., which compares favorably with the percentages (between 22.6 and 24.4) in the years from 1890 to 1895. The mortality among cases treated by other means during the same epidemic as that in which the serum was employed was 24.9 per cent. The untoward effects of the injections were similar to those observed after injections of diphtheria antitoxin.

Syphilis.—The pathogenic source of syphilis is still unknown. The disease being contagious, attempts have long been made to discover its specific microbe, yet the highest authorities agree that as yet all researches have proved abortive. No lower animal is known to be susceptible to the malady, and, although various experiments have seemed to prove the contrary, it is now determined that the lesions primarily indicating contraction of syphilis were the result

epticemia induced by some agent infected with the syphilitic

ıe sero-therapeutic methods employed in the treatment of the
se consist of inoculation with the blood of naturally immune

or of syphilitic subjects. Of all animals, the horse is perhaps the only one capable of syphilization.

Tommasoli in 1892–93 essayed inoculation of public women, affected with acute secondary syphilis, with lamb's serum, the results being, according to his report, highly favorable—even to the cure of syphilitic infection. Many untoward symptoms, however, have attended the inoculations thus made. Mozza (1893) instituted a series of experiments, employing blood from the carotid artery of a lamb or dog, and another series in which injections were made of serum drawn from sheep inoculated with serum from syphilitic subjects in whom the disease was latent. His records indicate no very satisfactory results, yet he demonstrated that aseptic precautions allow the application of serum-therapy without local or general reaction.

Finally, Héricourt and Richet attempted, with dubious success, the experimental injection of syphilitic serum, the results, in their therapeutic importance, being inconsequential.

Typhoid Fever.—The bacillus of this disease was first detected in the kidneys by Bouchard in 1879. The name was given by Eberth, who studied the germ in 1880–81. Old cultures contain an exceedingly toxic ptomaïne, besides a soluble substance capable of inoculating animals. The vigor of the bacillus of Eberth is remarkable, Grancher and Deschamps having shown that it survives five and a half months at a depth of 50 centimeters in damp soil. Infection may occur through the medium of the pulmonary tract, and the microbe is transmissible from the mother to the fetus.

All animals yet submitted to experiment are naturally immune, the first effort to inoculate them dating from 1862 (Murchison); the attempt proved futile. Other experiments in this direction were attended with like failure until Vidal and Chantemesse succeeded in inoculating with very virulent cultures 30 white mice, 17 of which succumbed within twenty-four hours.

Later experiments have proved the extreme virulence of serum derived from a typhoid human subject, fatality speedily resulting from its injection, caused not by the microbe itself, since none are found after death, but by its toxic products.

Among the phenomena observed in varied experimentation the inexplicable fact was revealed that the serum of certain persons never having contracted typhoid fever conferred immunity upon guinea-pigs.

Casual experiments followed without favorable progress, other than the reduction of temperature. In January, 1895, however, M. Legrain, turning his attention to typhus—so closely allied to true typhoid fever—met with encouraging success. Injecting successively increased doses of serum from typhus convalescents, besides the reduction of temperature within three hours after the operation it was noted that stupor, coma, and even hemiplegia of a toxic nature, disappeared after an injection of 10 cubic centimeters. In a case of grave typhus the injection of 14 cubic centimeters on the fourth day of the infection resulted in lowering the temperature and inaugurating recovery within two days. In other serious cases, where the injection was delayed until the sixth or eighth day of the infection's course, the disease, though not arrested, was marked by mitigated symptoms. The serum of convalescents was taken after one week's remission of febrile manifestations.

Relying upon the fact that an attack of typhus confers immunity against a second access of the disease, Stern sought to ascertain whether the serum of individuals cured was endowed with immunizing properties. The results were partially successful, eliciting the curious fact that the protective power of the serum appeared most active in those who finally succumbed to the disease. It also seemed problematical, to judge from these and other instances, whether immunized serum employed in this disease possesses either bactericidal or antitoxic properties.

Influenza.—Although the disease has occurred at intervals since the serious epidemic of 1830–33, the earliest microbiological studies of influenza date from the epidemic of 1889–90. Investigation at that time revealed no microbes in the sputum and viscera, save those which habitually frequent the bucco-pharyngeal cavity—streptococcus, pneumococcus, pneumo-bacillus, and staphylococcus—which diversity of germs might induce the belief that "la grippe" is not due to any single micro-organism, but to several.

Notwithstanding this and similar suppositions, the majority of microbiologists maintain that these bacteria are but the result of a secondary infection, and that the true germ of influenza is still unknown, although many investigators have thought they had isolated the specific microbe.

One deduction is constant as the result of their studies: the great importance of secondary infections in the course of the disease.

Failure to discover the germ was in reality due to a deficiency

of technique—inadequate methods of staining. Pfeiffer devised a new method, by which he detected it, and Kitasato (1892) succeeded in isolating and cultivating the identical microbe.

The bacteriologists of the Chicago Department of Health are at present studying the bacillus of influenza, which they have succeeded in isolating. Though it is a long journey from the discovery of a bacterium to the successful production of an antitoxin to the effects of that germ, still it is a matter of interest to know that the exact cause of the dread epidemic is at last known.

Animals do not contract the disease spontaneously, although the saliva of cats and dogs contains a bacillus having a pathogenic influence upon rabbits, the character of which closely resembles that of the Pfeiffer bacillus. Monkeys and rabbits contract the malady when inoculated with the pure culture of this germ.

In man the port of entry, so to speak, of this microbe is the pulmonary tract, where it often produces lesions of suppurating broncho-pneumonia. The general phenomena observed in the disease are held by Pfeiffer to be the result of intoxication, the microbes being localized; Cauch, on the contrary, considers them due to the presence of the microbe in all the organs, even the blood. The latest investigations confirm the opinion of Pfeiffer.

Brischettini has demonstrated that the propagation of the Pfeiffer bacillus is not checked by the action of serum from immunized animals, being limited to diminishing the toxicity of its soluble products. The immunity caused by the injection of these products is augmented by the injection of the culture.

The injection of serum of an immunized animal neutralizes *in vitro* the toxins secreted by the bacillus, and in a healthy organism establishes immunity, whether against infection or intoxication. It is therefore assured that in future use the serum may be employed at once as an inoculative and curative agent.

Reptile Poisons.—It has long been known that certain animals (reptiles) possess natural immunity against their own venom. The poison of the toad having been detected in his blood, the reptile's immunity was at first thought to be due to tolerance, the same condition existing in the salamander and viper.

The relation between the blood and the venomous glands demonstrates the internal secretion of these glands. The idea of an analogy between microbic virus and reptilian venom was deduced from the existence of soluble microbic toxins, as elucidated by Chauveau. The attenuating power of heat upon the venom of serpents has

also its analogue in the similar susceptibility of micro-organisms. A mortal dose of venom subjected for five minutes to a heat of 100° C. may be injected with impunity into a guinea-pig weighing 500 grammes.

The reaction of the organism engenders an antitoxin which, injected into a healthy animal, is preventive of fatal inoculation. The precise nature of this antitoxin is undetermined, yet its protective power is evident. Certain it is that the serum of a rabbit inoculated against viperous venom, when injected an hour and a half before the poison, completely neutralizes the latter. Curiously enough, this preventive serum of rabbits inoculated against the poison of vipers also confers immunity against cobra-venom.

So far as affects man, Calmette announces that he has employed serum with success in the treatment of snake-bites, even to the extent of curing them.

Carbuncle (Anthrax).—The bacterium of anthrax, of the genus bacillus, has proved a subject of elaborate and interesting experiment, many features of which are of absorbing interest alike to the bacteriologist and the clinician. The animals subjected to inoculation have been chosen with great care, and those supplying the immunizing serum include many species. The general results of protective inoculation have been treated briefly early in the discussion of serum-therapy.

Rabies.—In January, 1881, Galtier announced that intravenous inoculation of rabid saliva confers immunity upon sheep, confirming his experiments later in the year by injecting the fluid into nine sheep and one goat. Pasteur, Chamberland, Roux, and Thuiller pursued experiments in a similar line, with somewhat negative results.

By passing the virus successively from dogs to monkeys Pasteur was able to attenuate its virulence, and finally, by transferring the poison from monkeys to rabbits, a serviceable immunizing agent was obtained, still further experiments perfecting the method in view.

Satisfied with his success, Pasteur now turned his attention to the inoculation of man against hydrophobia. The first operation (in 1885) was attended with auspicious results, and from that moment the savant's laboratory was invaded by affected individuals demanding cure. Institutes were founded in various parts of the world, that in Paris being the center of bacteriological study in France. In America the subject has received wide attention, but

in many instances the benefits derived from Pasteur's inoculative procedure have been of doubtful importance among intelligent observers.

Pasteur's treatment of hydrophobia is based on the fact that rabic virus may be intensified or attenuated at will. If successive inoculations be made into rabbits with fluid taken either from the dog or the monkey, the virulence may be so increased above that of a street-dog, requiring from twelve to fourteen days for incubation, that after about one hundred inoculations the period of incubation may be reduced to seven or even six days. This, the most powerful virus yet attained, Pasteur termed *virus fixe*. When protected from light and air this virus retains its strength for a long period. Pasteur further observed that the cords of rabbits which had been dead for some time contained a less virulent poison than those of animals freshly killed, especially when the air was dry and the cord protected from putrefactive influences, the most efficient inoculation being that of an emulsion made from cords exposed to dry air for fourteen and ten days, followed by emulsions of cords exposed for shorter periods. That the student may more readily understand Pasteur's *modus operandi*, we will cite the case of Joseph Meister as treated by the savant:

"The description of the case of Joseph Meister has now become classical. This lad, nine years old, who was the first patient treated by this method, was bitten severely on the arms and legs by a mad dog on the 4th of July, 1885; his worst wounds were cauterized with carbolic acid about twelve hours after the bite. The dog was undoubtedly mad, and there was little chance of the survival of the patient; it was resolved, therefore, to apply to him the treatment which had been so successful in the case of dogs, and to give him the only apparent chance of recovery. Thirteen injections were made in ten days: two on the first day with emulsions made from cords that had been exposed to dry air for fourteen and ten days respectively; two on the second day with emulsions of cords that had been exposed for eleven and eight days respectively, and then, on each following day up to the tenth, with emulsions of cords exposed for eight, seven, and six days down to one day; and on the last day with that of the fresh cord of a rabbit in which the virus retained its full virulence. In order to control the results, for every injection that was made into the child a corresponding one was made into a rabbit; and it was found that of the five rabbits so inoculated with the first five injecting materials, not one mani-

fested symptoms of hydrophobia; but the other eight all succumbed to the disease, the period at which they died being shorter as the cords exposed to the dry air for shorter and shorter times were successively injected. The patient, thus gradually prepared by the earlier inoculations, was not in the slightest degree affected by the stronger virus; and five years afterward the boy was still perfectly well."

With regard to the administration of serum, several precautions are of great importance. The absolute cleanliness of the syringe, for example, should be an object of especial care. To this end a glass barrel is preferable, in order that impurities may be readily detected and removed. For packing purposes rubber or asbestos should be employed, and the instrument should be so constructed as to permit cleansing and sterilizing of every part before and after use.

The mode of injection and the amount of dosage (measured in antitoxin units) vary somewhat according to the nature of the disease and the age and susceptibility of the patient. Care should be taken to use only the most reliable preparations.

It has been impossible to present within a necessarily limited space the entire field covered by this profoundly interesting subject. For a multitude of details, embodying a wide range of experimentation, and for many expressions of individual opinion awakened by a consideration of so absorbing a theme, the student is referred to the extensive bibliography relating to every phase of serum-therapy.

It may be readily imagined what would have been the discussion of Jenner's vaccination had our bacteriological and chemical knowledge and delicate appliances for investigation existed in his day. It is scarcely surprising, therefore, that the renewal of similar studies, after an interval of unprecedented scientific progress, should elicit from all parts of the world a zeal and enthusiasm impossible in any previous epoch, together with a mass of concurrent or dissenting testimony touching new discoveries proportionate to the greatly increased number of competent investigators. Whatever be the limitations of serum-therapy, the consensus of opinion among thoughtful observers is that its importance to mankind and its purpose are deeply rooted in the eternal laws of matter and the methods of great Nature. Its rationale, its mysterious power, and

startling phenomena awaken new and greater problems of bacteriological science; yet, though the entire subject, embracing as it does so ample and momentous a field of inquiry, remains *sub judice*, the character of modern scientific investigation must surely reveal its truth or falsity.

DIVISION III.—ANTISEPTICS.

Ăcidum Carbŏlicum—Ăcidi Carbŏlici—Carbolic Acid. *U. S. P.*

Origin.—A constituent of Coal-tar, obtained by fractional distillation and subsequently purified.

Description and Properties.—Colorless, interlaced, or separate, needle-shaped crystals, or a white, crystalline mass, sometimes acquiring a reddish tint, having a characteristic, somewhat aromatic odor, and, when copiously diluted with water, a sweetish taste, with a slightly burning after-taste. Deliquescent on exposure to damp air.

Soluble in about 15 parts of water, the solubility varying according to the degree of hydration of the acid; very soluble in alcohol, ether, chloroform, benzol, carbon disulphide, glycerin, and fixed and volatile oils. It is liquefied by the addition of about 8 per cent. of water. The vapor of the acid is highly inflammable. Carbolic acid is faintly acid to litmus-paper. It should be kept in dark amber-colored, well-stoppered bottles.

Dose.—½–2 grains (0.03–0.12 Gm.). If liquefied, 1–2 minims (0.03–0.12 Cc.).

Official Preparations.

Glycerītum Ăcidi Carbŏlici—Glycerīti Ăcidi Carbŏlici—Glycerite of Carbolic Acid (25 per cent.).—For external use.

Unguĕntum Ăcidi Carbŏlici—Unguĕnti Ăcidi Carbŏlici—Ointment of Carbolic Acid (10 per cent.).—For external use.

Unofficial Preparations.

Āqua Ăcidi Carbŏlici—Āquæ Ăcidi Carbŏlici—Carbolic Acid Water.—Strength, 2 drachms in 1 pint (8.0–473.17 Cc.). *Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Ōleum Ăcidi Carbŏlici—Ōlei Ăcidi Carbŏlici—Carbolated Oil.—1 in 20 of Olive or Cotton Seed Oil. For external use.

Cărbasus Ăcidi Carbŏlici—Cărbasi Ăcidi Carbŏlici—Carbolic Acid Gauze.—Gauze containing Carbolic Acid, 1; Resin, 5; Paraffin, 7 parts. Used as a surgical dressing.

Emplăstrum Ăcidi Carbŏlici—Emplăstrum (acc.) **Ăcidi Carbŏlici—Carbolic Acid Plaster.**—Composed of Carbolic Acid, 25; Shellac, 75; coated with Guttapercha dissolved in Carbon Disulphide. For external use.

Camphōra Carbolisāta—Camphōræ Carbolisātæ—Camphorated Carbolic Acid (PHENOL-CAMPHOR).—Camphor, 2; Carbolic Acid, 1; allow to liquefy. A colorless, oily liquid, having the odor of camphor, soluble in fixed oils, alcohol, and ether, nearly insoluble in water and glycerin. Used as a local anesthetic, chiefly for toothache.

Līquor Sōdii Carbolātus—Liquōris Sōdii Carbolāti—Phenol-Sodique.—Composed of Carbolic Acid, 188 grains (12.5 Gm.); Caustic Soda, 31 grains (2.06 Gm.) Distilled Water, 4 ounces (118.29 Cc.). For external use.

Līquor Sōdii Borātis Compŏsitus—Liquōris Sōdii Borātis Compŏsiti—Dobell's Solution.—Composed of Borax and Sodium Bicarbonate, of each, 2 drachms (15.0 Gm.); Carbolic Acid, 24 grains (1.8 Gm.); in Water, 1 pint (473.17 Cc.). Used externally in spray.

Ăcidum Carbŏlicum Iodātum (N. F.)—Ăcidi Carbŏlici Iodāti—Iodized Carbolic Acid (PHENOL IODATUM).—Composed of Iodine, 20 parts; Carbolic Acid, 76 parts; Glycerin, 4 parts. The iodine, the acid which has been previously melted, and the glycerin are put in a flask, digested at a gentle heat, and frequently agitated until the iodine is dissolved. It should be kept in glass-stoppered bottles in a dark place. Used locally, especially in gynecological practice.

Allied Compounds.

Creasols.—Obtained by distilling Coal-tar between 200° and 210° C.; also obtained by fusing Toluene Sulphonic Acid with Potash. The familiar compounds of creasols are *Crealin*, *Lysol*, *Solutol*, *Saprol*, etc. They are powerful disinfectants and germicides, and less poisonous than carbolic acid. *Aseptol*, or orthophenol-sulphonic acid, is a commercial article, a straw-colored, slightly caustic liquid. It is a powerful antiseptic.

Antagonists and Incompatibles.—Bromine, metallic salts, antipyrine, collodion, alkalies, saccharate of lime or lime, and soluble sulphates like Epsom or Glauber salts, are incompatibles. Atropine is a physiological antagonist.

Synergists.—All members of the carbolic-acid group, antiseptics, and motor depressants.

Physiological Action.—*Externally.*—Carbolic acid is a local anesthetic, and, applied in full strength to animal tissues, acts as a caustic, but does not produce vesication. In weaker solutions it produces a burning and reddening of the skin. It acts more severely upon mucous membranes. It coagulates albumin, and therefore its caustic action is limited.

The eschar is first whitish, subsequently becoming brownish. It is readily absorbed through the skin or through raw surfaces, and toxic effects have been thus produced. Weak solutions are antipruritic and gratefully cooling and anodyne. It is a disinfectant, a deodorant, and a parasiticide.

Internally.—Digestive System.—In small doses it is cooling and sedative to the stomach. In large or poisonous doses it is a powerful gastro-intestinal irritant. Ordinary medicinal doses are converted by the gastric contents into the sulphocarbolates.

Circulatory System.—Medicinal doses have no apparent effect on the circulation. Large doses first depress and later accelerate the heart. Poisonous doses powerfully depress the heart, stopping it in diastole. The arterial tension is lowered by lethal doses, from paralysis of the vaso-motor center in the medulla.

Nervous System.—Medicinal doses have no special effect upon the nervous system. Large or poisonous doses depress the cerebrum. Vertigo may first be noticed, which is soon followed by stupor. Owing to stimulation of the anterior cornua of the spinal cord, there may be muscular trembling or convulsions. The cornua are ultimately depressed, causing abolition of reflexes and paralysis.

Respiratory System.—Small doses do not affect the respiration. Large doses first accelerate the respiratory movements, rendering them full, but shallow respirations soon follow. This action is due to stimulation of the vagi, both at the periphery and at the center. If the dose has been a poisonous one, there is great depression, and ultimately paralysis of respiration, due to depression of the centers.

Absorption and Elimination.—It is absorbed from the stomach, and diffuses into the blood with great facility, circulating in that tissue probably as an alkaline carbolate.

It is eliminated by all the secretions—chiefly by the kidneys and lungs—and appears in the urine as salts of sulphocarbolic and glycuronic acids, and the oxidated products hydrochinon and pyrocatechin. To the last substance is mainly due the peculiar smoky or olive-green color imparted to the urine after large or continued doses have been taken. (There is also, probably, some other factor causing this change, for pyrocatechin can exist only in alkaline urine.)

When a very large amount of carbolic acid has been taken, some of it can be found in the urine unchanged.

Temperature.—It is not specially affected by small doses. Full medicinal doses tend to lower bodily temperature in fever, while poisonous doses lower the temperature several degrees. The reduction of temperature is due to its diminishing heat-production and increasing heat-dissipation.

Eye.—Poisonous doses almost invariably cause the pupil to be minutely contracted, due, probably to paralysis of the radiating fibers, the circular fibers being unaffected.

Untoward Action.—Headache, either in the frontal or the occipital region, heaviness and a sensation of fulness in the head, dizziness, and the appearance of rings before the eyes, muscular weakness, especially of the legs, profuse sweating, formication.

Where there is an idiosyncrasy on the part of the individual against this drug, small doses even may produce the symptoms of poisoning.

Poisoning.—Carbolic acid is one of the most deadly poisons, often equalling hydrocyanic acid in its rapidity of action.

The patient is rendered rapidly unconscious or may drop dead within a very few moments from paralysis of respiration. Should the dose be insufficient to produce so sudden a death, the patient suffers from all the symptoms of gastro-enteritis—intense pain, with violent vomiting and purging. Fibrillary trembling may be present. Stertorous breathing appears, with cold, clammy skin, pinched face, anxious expression, abolition of reflexes, weak, thready, and often imperceptible pulse, feeble respiration, and frequently dyspnea, and death finally occurs from failure of respiration.

As toxic symptoms may be produced by the external application of solutions of carbolic acid, as in surgical dressings or vaginal or intra-uterine douches, the toxicity of this drug should be appreciated, and patients carefully watched for the first untoward manifestations, such as pain in the lumbar region, smoky urine, nervousness, and cerebral disturbance, when the drug should be immediately withdrawn.

Treatment of Poisoning.—The immediate administration of magnesium sulphate (Epsom salts) and warm demulcent drinks should be resorted to. The application of external heat. Atropine and strychnine hypodermically. Digitalis and coffee may also be required. Opium, or some preparation of it, for the relief of pain. If the patient is seen soon after the drug has been taken, the stomach should be washed out, after which the above treatment should be followed.

Therapeutics.—*Externally and Locally.*—For some time after it was so prominently brought forward by Lister carbolic acid was thought to be indispensable in antiseptic surgery. It is now known that the solutions which are safe to use are inefficient, ordinarily, beyond the mere mechanical effect of washing.

The benumbing influence produced on the hands of the surgeon, and the discoloration of bright instruments and rapid impairment of their cutting surfaces, render strong solutions for disinfecting instruments impracticable, and indeed of less value for this purpose than the prolonged boiling in distilled water rendered slightly alkaline with sodium bicarbonate.

The pain of superficial *burns* is relieved by applying strong solutions of carbolic acid, care being taken to prevent absorption.

It is an extremely valuable drug as an antipruritic, and is hence of great utility in the treatment of certain *diseases of the skin—pruritus, chronic eczema.* In *chilblains, tinea tonsurans, t. capitis, t. circinata, favus,* etc. it is of great value. *Chronic laryngitis,* characterized by diminished secretion, is greatly benefited by the direct application to the parts of a solution of ½ drachm to 1 ounce of glycerin (2.0–30.0 Cc.). A spray containing from 2 to 5 grains (0.12–0.36 Gm.) to 1 ounce (30.0 Cc.) of water is an efficient application in the treatment of *acute* and *chronic inflammation of the throat and nose.*

Camphorated carbolic acid (campho-phenique) is a useful application in *toothache* due to an exposed and inflamed pulp.

As a deodorant it is valuable to correct the fetor arising from *syphilitic ulcerations, carcinoma, gangrene of the lungs, bronchorrhea, pneumothorax,* etc.

It reduces the discharge and relieves the pain in acute *otitis media:* a 10 per cent. solution in glycerin should be used. It is also of value in the treatment of *otorrhea* and in *acute perforations of the tympanic membrane,* but should be used in much weaker solutions—1 or 2 per cent.

A lotion, 8 to 15 grains (0.5–1.0 Gm.) to 1 ounce (30.0 Cc.), is an efficient antiseptic in *foul* and *indolent ulcers.*

The pure acid is used as a *cauterant* in *chancroids, lupus, gangrene, bites of rabid animals,* etc.

The iodized carbolic acid is a valued local remedy in *endometritis, chronic endocervicitis,* and *ulcers of the cervix.*

Hüter in 1878 advocated the use of hypodermic injections of a 3 per cent. solution of carbolic acid for *erysipelas,* the punctures to be made at intervals upon the edge of the inflammation.

Great improvement has taken place in *goître* after the treatment by hypodermic injections into the tumor of a 5 per cent. solution of carbolic acid.

Internally.—While inferior to salicylic acid to *check fermentation,*

it is nevertheless used for that purpose in *dilatation of the stomach* and so-called *fermentative* or *flatulent dyspepsia.*

In nervous and irritative *vomiting* it may be given in doses of from 1 to 2 minims (0.06–0.12 Cc.), well diluted and repeated at intervals of from one to four hours according to the symptoms of the case.

It has been used in *acute* and *chronic dysentery*, and as an anthelmintic against *ascarides* and *tænia solium.*

It has also been advocated as a remedy for *typhoid fever* and in *malarial cachexia*, but purely upon theoretical grounds, no clinical results having thus far justified its use in these disorders.

Administration.—It may be given internally in pills or capsules, mixed with powdered liquorice-root as an excipient, or dissolved in glycerin and well diluted with sweetened water.

For external use various strengths are used (from 1 : 10 to 1 : 500), and the various preparations mentioned may be used according to the case and indications. It is to be noted that a strength above 1 : 10 is liable to produce vesication.

Sōdii Sulphocărbolas—Sōdii Sulphocarbolātis—Sodium Sulphocarbolate. *U. S. P.*

Description and Properties.—Colorless, transparent, rhombic prisms, odorless, having a cooling, saline, slightly bitter taste. Somewhat efflorescent in dry air. Soluble in 4.8 parts of water, 132 parts of alcohol, 0.7 part of boiling water, and in 10 parts of boiling alcohol. The aqueous solution is neutral to litmus-paper.

Dose.—10–30 grains (0.60–2 Gm.).

Allied Compounds.

Potăssii Sulphocărbolas—Potăssii Sulphocarbolātis—Potassium Sulphocarbolate.

Călcii Sulphocărbolas—Călcii Sulphocarbolātis—Calcium Sulphocarbolate.

Magnēsii Sulphocărbolas—Magnēsii Sulphocarbolātis—Magnesium Sulphocarbolate.

Zĭnci Sulphocărbolas—Zĭncii Sulphocarbolātis—Zinc Sulphocarbolate.

All of the above have been employed, but the zinc sulphocarbolate is believed to be preferable to check diarrhea and render the stools less foul. It is best given in pills, in doses of 2–3 grains (0.1–0.15 Gm.).

Physiological Action.—In medicinal doses SODIUM SULPHOCARBOLATE occasions no special symptoms, and in three or four times the medicinal dose it causes only slight lightness of the head.

It is changed in the system into carbolic acid and sodium sul-

phate, the latter being eliminated with the urine. The carbolic acid set free exerts its characteristic action and influence.

Therapeutics.—*Externally and Locally.*—In the strength of ½ drachm (2.0 Gm.) to 8 ounces (237.0 Cc.) of water it forms a valuable gargle in *relaxed conditions of the throat.*

Solutions of different strengths have been used in *diphtheria, acute tonsillitis, aphthæ* of children, and *nasal catarrh.*

30 grains (2.0 Gm.) in 2 ounces (60.0 Cc.) each, of water, and hydrogen peroxide make an efficient injection in *gonorrhea.*

Internally.—It is a mild intestinal antiseptic, and may be used internally for the same purposes as carbolic acid in such disorders as *diarrhea, fermentative dyspepsia*, etc. It arrests the growth of *thrush*, and is considered by some physicians to exert a favorable action in *anginose scarlatina, diphtheria*, and *typhoid fever.* The ZINC SULPHOCARBOLATE is one of the best intestinal antiseptics to use in cases of *dyspeptic diarrhea* of children.

Administration.—Sodium sulphocarbolate is best given in solution.

Creosōtum—Creosōti—Creosote. *U. S. P.*

Origin.—A mixture of phenols, chiefly Guaiacol and Creosol, obtained during the distillation of wood-tar, preferably that of beech.

Description and Properties.—An almost colorless, yellowish or pinkish, highly refractive, oily liquid, having a penetrating smoky odor, and a burning, caustic taste; usually becoming darker in tint on exposure to light. Soluble in about 150 parts of water, but without forming a perfectly clear solution. With 120 parts of hot water it forms a clear liquid which on cooling becomes turbid, from the separation of minute oily drops. Soluble in all proportions in absolute alcohol, in ether, chloroform, benzin, carbon disulphide, acetic acid, and in fixed and volatile oils. Creosote is inflammable, burning with a luminous, smoky flame. It is neutral, or only faintly acid, to litmus-paper.

Tests.—Carbolic acid is often substituted for creosote, and the following tests for the detection of carbolic acid are important:

1. If the suspended liquid is mixed with collodion, a coagulum will form if carbolic acid be present.

2. Carbolic acid produces a violet color with ferric chloride and ammonium hydrate, creosote producing a green color passing to brown.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparation.

Āqua Creosōti—Āquæ Creosōti—Creosote Water.—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Incompatibles.—Strong sulphuric and nitric acid. It reduces silver salts, and explodes when combined with oxide of silver.

Synergists.—The same as for carbolic acid.

Physiological Action.—*Externally.*—It has the same action as carbolic acid.

Internally.—Its action upon the digestive, circulatory, nervous, and respiratory systems is practically the same as that of carbolic acid.

It does not stimulate the spinal cord so much as carbolic acid, and differs also from the latter drug in increasing the coagulability of the blood. Poisonous doses act like those of carbolic acid, but with more marked nervous symptoms.

Absorption and Elimination.—It is eliminated by the bronchial mucous membrane, and by the kidneys as guaiacol sulphate and creosol sulphate of potassium.

It is a stimulant expectorant.

It has the peculiar property when applied to meat of preserving it, whence its name (*creas*, flesh, *sohzote*, preserve).

Poisoning.—The symptoms and treatment of poisoning from creosote are the same as described under *Carbolic Acid.*

Therapeutics.—*Externally and Locally.*—Creosote is superior to carbolic acid as an antipruritic, although not so generally used as the latter, on account of its acrid and penetrating odor. It can be used externally for the same purposes as carbolic acid. It is a valuable hemostatic, and the creosote water may be used for this purpose.

Inhalations of creosote are recommended in *phthisis*, *chronic bronchitis*, and *chronic congestion of the larynx* and *trachea*. It is a powerful local anesthetic, and is largely used by dentists and the laity for *aching teeth.* It is used to preserve dead animal matter for *dissection*, etc.

Internally.—Creosote can be used internally for the same purposes as carbolic acid, having the advantage over the latter drug in being one of the most efficient remedies in *pulmonary tuberculosis.* Probably no one remedy exerts so favorable an action upon the night-sweats, cough, and expectoration as creosote, or guaiacol, which is preferred by many physicians. It is of less value in cases

accompanied by high temperature and hemoptysis, and ... aggravates these symptoms.

It must be remembered that many of the cases alleged to have been cured by creosote have been treated with cod liver oil, tonics, and hygienic methods as well.

Contraindications.—The same as for carbolic acid.

Administration.—Pure beech-wood creosote alone should be used. It may be given in the form of creosote water, emulsion, or pills, or in capsules mixed with cod liver oil. Capsules are the least offensive way of administration. Some persons prefer to take the drug in milk.

In the treatment of phthisis large doses are necessary. A tolerance can usually be established by gradually increasing doses. If the patient manifest any untoward symptoms, the drug must be reduced in quantity or discontinued altogether.

Guaiăcolum—Guaiăcoli—Guaiacol.

Origin.—As before stated, creosote consists chiefly of Guaiacol, Creosols, and Cresols, and of these guaiacol is present to the extent of from 60 to 90 per cent.

Guaiacol is obtained by fractional distillation of beechwood-tar Creosote, treated with Ammonia to remove acid compounds, and again fractionated.

Guaiacol is rarely met with absolutely pure.

Description and Properties.—A colorless, slightly refractive liquid, of strongly aromatic odor. Specific gravity at 15° C. (59° F.) is 1.117. Sparingly soluble in water, but readily soluble in alcohol and ether. It is soluble in solutions of sodium and potassium hydroxides, forming unstable compounds known as sodium- and potassium-guaiacol.

Tests.—Pure guaiacol will separate rapidly if shaken with twice its weight of benzene, whereas the impure article forms a clear solution.

"If a trace of ferric chloride is added to an alcoholic solution of guaiacol, a blue color is developed, which changes to emerald-green upon the addition of more ferric chloride."

Dose.—2–10 minims (0.12–0.6 Cc.).

The following derivatives have been introduced:

Guaiăcoli Bĕnzoas—Guaiăcoli Benzoātis—Guaiacol Benzoate (Benzosol) —*Origin*, by heating on a water-bath Potassium Guaiacol with Benzosol-chloride: the impure benzosol-guaiacol formed is purified by recrystallization from Alcohol.

Description and Properties.—Colorless, tasteless, and odorless crystalline powder, almost insoluble in water, but readily soluble in ether, chloroform, and hot alcohol.

Dose.—10–150 grains (0.60–10 Gm.) daily.

Guaiăcoli Carbōnas—Guaiăcoli Carbonātis—Guaiacol Carbonate.—*Origin*, this substance is prepared by passing Phosgene Gas (carbonyl chloride) into Guaiacol previously dissolved in soda solution. The guaiacol carbonate is formed and is purified and crystallized from Alcohol.

Description and Properties.—White, neutral, crystalline powder, nearly void of odor and taste, insoluble in water, slightly soluble in cold and readily soluble in hot alcohol, also in ether, chloroform, and benzene, and sparingly soluble in glycerin and fixed oils.

Dose.—3–60 grains (0.2–4 Gm.) daily, gradually increased.

Guaiăcoli Dī-iōdidum—Guaiăcoli Dī-iōdidi—Guaiacol Diodide.—*Origin*, by adding a solution of Iodine in potassium iodide to an aqueous solution of Sodium-guaiacol as long as precipitation continues.

Description and Properties.—Reddish-brown salt, having the odor of iodine, soluble in alcohol and fixed oils, and readily decomposed.

Dose.—2–15 grains (0.10–1 Gm.).

Guaiăcoli Sallĭcylas—Guaiăcoli Salicylātis—Guaiacol Salicylate (GUAIACOL-SALOL).—*Origin*, by the action of Phosphorous Oxychloride on a mixture of Sodium-guaiacol and Salicylate. It is analogous to salol.

Description and Properties.—White, crystalline, odorless, and tasteless powder, insoluble in water, but soluble in alcohol, ether, and chloroform.

Dose.—10–150 grains (0.60–10 Gm.) daily.

Physiological Action of Guaiacol and its Derivatives.—GUAIACOL produces an action very similar to that of creosote. It is not caustic when applied in full strength. It possesses marked antipyretic properties. It is readily absorbed through the unbroken skin, and rapidly reduces febrile temperature when applied in this manner. The reduction of temperature lasts from four to six hours.

It is a diaphoretic and diuretic. It is excreted by the sweat, saliva, and urine, but is only slightly thrown out by the expired air, though small amounts of the drug have been found in the lung-tissue. As it is eliminated as a salt of ethyl-sulphuric acid, it must combine with albuminous bodies in the blood, and chiefly through the sulphur present in the albumin molecules. It can be found in the urine within fifteen minutes after administration or external application in the form of a substance giving the reaction of phenol.

It is more agreeable to the stomach than creosote, and frequently improves the appetite, though to some patients it is very disagreeable and acts as an irritant.

The GUAIACOL CARBONATE is usually much better borne by the stomach, and is therefore a useful and efficient substitute.

BENZOSOL, GUAIACOL BENZOATE, contains 54 per cent. of guaiacol. It is usually well borne by the patient, and seldom occasions any digestive disturbance. In the intestinal canal it resolves into guaiacol and benzoic acid, and is excreted by the urine as combinations of these substances.

Therapeutics.—GUAIACOL is used for the same purposes as creosote—less likely to irritate the intestinal canal and kidneys.

GUAIACOL causes a marked reduction of the temperature in cases of *tubercular disease* when applied locally, nor is the antipyretic action when thus employed confined to tuberculous cases. It has given satisfactory results in other pyrexias. It is a very active antipyretic in *erysipelas*. The temperature begins to fall within fifteen or twenty minutes after the application of the drug. As with all antipyretics, the depressing action of guaiacol must be borne in mind.

Raymond first suggested the local application of guaiacol in *tonsillitis*. It undoubtedly exerts a favorable action on the disease.

Guaiacol, or some one of its derivatives, has been substituted for creosote in the treatment of *phthisis* and other wasting forms of tuberculosis. Guaiacol itself has no advantage over creosote. The BENZOSOL and GUAIACOL CARBONATE possess the only advantage of being tasteless.

Piatkowski of Vienna recommends BENZOSOL in *diabetes mellitus*. There have been conflicting reports regarding its efficacy, yet sufficient is known in its favor to justify a further trial of this drug in diabetes.

Contraindications.—The same as for creosote.

Administration.—The application of guaiacol for the reduction of temperature may be made upon any portion of the skin—the back, breast, arms, thighs, or abdomen—without causing any appreciable difference. From ½ to 1 drachm (2.0–4.0 Cc.) is applied with a brush, and the part covered with cotton or gutta-percha tissue. The application may be repeated as often as necessary for the reduction of the fever.

Other than a decided taste of guaiacol and free diaphoresis, the patient usually complains of no untoward symptoms, although in some cases quite marked nervous disturbances and other unfavorable manifestations have been observed.

It may be inhaled from hot water for certain conditions in doses of from 5–10 minims (0.3–0.6 Cc.).

The solid derivatives of guaiacol may be given in powders or capsules. Guaiacol itself may be given in the same manner as creosote—preferably, mixed with cod liver oil or enclosed in capsules.

Ăcidum Salicўlicum—Ăcidi Salicўlici—Salicylic Acid. *U. S. P.*

Origin.—An organic acid, existing naturally in combination in various plants like *Spiræa ulmaria* (meadow-sweet), *Gaultheria procumbens* (wintergreen), etc., but chiefly prepared synthetically by combining the elements of pure Carbolic Acid with dry Carbonic Acid and purifying.

Description and Properties.—Light, fine, white prismatic needles, or a light white crystalline powder, odorless, having a sweetish, afterward acrid taste; permanent in the air. It is soluble in about 450 parts of water, in 2.4 parts of alcohol, and in 14 parts of boiling water. The addition of 2 parts of sodium sulphite or 1 part of ammonium phosphate renders it much more soluble in water.

Test.—The addition of ferric chloride to a saturated solution produces a fine bluish-violet color.

Dose.—3–60 grains (0.25–4.0 Gm.).

Lĭthii Salĭcylas—Lĭthii Salicylātis—Lithium Salicylate. *U. S. P.*

Origin.—Obtained by heating Salicylic Acid, Lithium Carbonate, and Water until effervescence ceases, filtering, and evaporating.

Description and Properties.—A white or grayish-white powder, odorless, having a sweetish taste, deliquescent on exposure to air, very soluble in water and alcohol.

Dose.—5–60 grains (0.3–4.0 Gm.).

Sōdii Salĭcylas—Sōdii Salicylātis—Sodium Salicylate. *U. S. P.*

Origin.—Prepared by acting on Sodium Carbonate with Salicylic Acid, straining, and heating the solution.

Description and Properties.—A white amorphous powder, odorless, sweetish, saline taste, permanent in air, soluble in 0.9 part of water, in 6 parts of alcohol, and in glycerin.

Dose.—5–60 grains (0.3–4.0 Gm.).

Antagonists and Incompatibles.—The arterial and cerebral stimulants are antagonistic to salicylic acid and the salicylates. The incompatibles are the mineral acids, alkalies, metallic salts, particularly the ferric salts.

Synergists.—The carbolic-acid derivatives, anesthetics, cardiac depressants, and cerebral sedatives.

Physiological Action.—*Externally and Locally.*—Salicylic acid is antiseptic, parasiticide, irritant to mucous membranes; possesses the power to soften the epidermis; checks perspiration when locally applied (anhydrotic).

Internally.—Digestive System.—Small doses stimulate the stomach; larger doses act as an irritant. It is an antiferment.

Circulatory System.—Small doses of salicylic acid have no very appreciable effect upon the circulation. Full medicinal doses first cause the heart to beat faster and stronger, increasing arterial tension; later the arterial pressure is lowered, and excessive or toxic doses cause the pulse to become slow and labored. Its tendency ultimately, even in medicinal doses, is to depress rather than stimulate the heart. Its effect upon the blood is to restrain the migration of the white corpuscles.

Nervous System.—In toxic doses, and in some susceptible persons in full medicinal doses, salicylic acid causes cerebral congestion, indicated by a feeling of tension in the cerebrum, headache, confusion of thought, tinnitus aurium, vertigo, and sometimes delirium. Toxic doses may occasionally produce cerebral convulsions. It lessens the reflexes, but does not affect the peripheral nerves, either motor or sensory.

Respiratory System.—Small doses stimulate the respiratory center and the pulmonary vagi, making the respiration quicker and deeper. Toxic doses paralyze the center and vagi, causing slow and labored respiration and death from asphyxia.

Absorption and Elimination.—Salicylic acid is converted by the gastro-intestinal secretions into the sodium salicylate, in which form it enters into the circulation.

It increases the urinary flow. It appears in the urine as salicyluric acid. The color of the urine is changed to a dark olive-green after large doses have been taken. This change is due to the presence of indican and pyrocatechin, produced by the action of the pancreatic juice upon the salicylic acid in the intestine.

It is a powerful diaphoretic, large doses often causing exhausting sweating. It also increases the secretion of milk and the amount of sugar in that secretion.

Elimination takes place slowly by all the emunctories, but chiefly through the kidneys and skin.

Temperature.—Febrile temperature is markedly reduced by large doses of salicylic acid. The reduction takes place usually within half an hour after a dose has been taken, and lasts several hours. The antipyretic action varies in degree according to the cause of the pyrexia and the individual susceptibility of the patient. The reduction of temperature is produced by lessening heat-production and increasing heat-dissipation.

Untoward Action.—Erythema, urticaria, or petechiæ, accompanied by intense itching, occasionally edema of the eyelids and lower extremities, mental depression, muscular weakness, motor disturbances, sweating, and buzzing in the ears, as mentioned under Poisoning, but to a less degree. Prolonged administration may also produce anemia.

Poisoning.—There are roaring in the ears, deafness, intense headache, vertigo, and possibly delirium, profuse and exhausting sweating, subnormal temperature, very weak, compressible pulse, feeble and shallow respirations, dimness of vision, ptosis, and often strabismus. The blood is disorganized, and the corpuscles rapidly break down. The urine and feces pass involuntarily. Death usually results from respiratory failure.

Treatment of Poisoning.—Diffusible stimulants, atropine, strychnine—the same treatment as in poisoning by acetanilid.

Therapeutics.—*Externally and Locally.*—SALICYLIC ACID has been satisfactorily employed, in the strength of ½ to 1 drachm in 1 ounce (2.0 to 4.0 in 32.0 Gm.) of cosmoline, in the treatment of *erysipelas.*

In the treatment of *chancroid* salicylic acid has been extensively employed. The powdered acid should be thoroughly dusted over the surface.

The peculiar action of salicylic acid in softening and loosening thickened masses of epidermis and favoring the normal proliferation of epithelium renders the drug especially useful in the treatment of *indurated eczema*, particularly of the palm and sole, *verruca, tylosis, callositas, corns, warts*, etc.

It is one of the most useful drugs in the different varieties of *eczema, impetigo contagiosa, psoriasis, lupus, parasitic affections*, and in *non-parasitic sycosis* it has been employed by Heitzmann with

marked success. It has been used successfully in the treatment of *acne*, *comedones*, and *pruritus*. A 3 per cent. solution has been recommended in *aspergillus* of the outer auditory meatus. A wash, 3 grains to 1 ounce (0.2 to 30.0 Cc.) is efficient in *otorrhea*. Solutions of various strengths are frequently useful in *acute coryza*, *diphtheria*, *inflammation of fauces*, *catarrhal stomatitis*, and to correct *offensive expectoration*, especially in *phthisis* and *gangrene of the lung*.

Internally.—There is no better example of empiricism in therapeutics than the employment of SALICYLIC ACID in *acute articular rheumatism*. Used at first in this disease to reduce temperature, it was found that while it exerted marked antipyretic action, it also lessened the pain and swelling, and in the majority of cases shortened the duration of the disease. It cannot be classed as a "specific" in any sense of the word, but merely relieves certain symptoms—fever, pain, and swelling. Other symptoms—or complications, according to some authors—such as heart affections, are uninfluenced by this medicine. Indeed, when so-called cardiac complications exist salicylic acid is certainly contraindicated. It has no power to prevent either affections of the heart or relapses. In the author's opinion, it is doubtful if salicylic acid alone is equal to the alkaline treatment or greatly superior to acetanilid or antipyrine.

Rheumatic tetanus, *irido-choroiditis*, and *sclerotitis* are alleged to have been cured by this drug. It is useless in *gout*, according to the best English authorities, and is of no value in *chronic* or *gonorrheal rheumatism*, *rheumatic arthritis*, or *rheumatic hyperpyrexia*.

It is credited with being quite efficient in *chorea* of rheumatic origin, and in relieving the pains of *herpes zoster* and *neuralgic headache*.

It is a drug to be tried in many diseases of rheumatic origin, unless some distinct contraindication to its use exists. It surpasses any drug, with the possible exception of guaiac, in the treatment of *quinsy*, and particularly *rheumatic tonsillitis*. The medicine is highly regarded by competent advocates as a remedy in *diphtheria*. *Lumbago* often yields to its influence, and it has also been recommended in *sciatica*, although in Cook County Hospital the author has seen a great number of cases of the latter treated with salicylic acid without any apparent improvement. He also regards it as valueless in *typhoid* and *intermittent* fevers.

It is a useful antizymotic to prevent *putrefactive fermentation* and *flatulence*, and lessen thereby the tendency to *crapulous diarrhea*.

Owing to the similarity of its action to that of quinine, it has been used, and with some success, in *periodical neuralgias* which have not responded to the latter drug.

It has been found of use in *influenza*, and is an efficient antiseptic remedy in *chronic gastric catarrh*, *diarrhea*, *cholera*, and *entero-colitis*. By some eminent clinicians it is considered to be one of the most effectual remedies in *pleurisy* with effusion.

It has been recommended as an effectual anthelmintic, both for *tape-* and *round-worms*.

Contraindications.—Salicylic acid should not be given in large doses to persons who have a weak heart or are otherwise greatly debilitated, at least not without counteracting its toxical tendencies with nutrients and diffusible stimulants.

Administration.—Owing to its irritant action upon the mucous membranes, it is best given in a solution of glycerin and some aromatic water, after meals. So concentrated a form as a pill or capsule is not recommended.

Many of the untoward cerebral effects may be relieved by giving 20 grains (1.3 Gm.) of sodium or potassium bromide.

Many of the toxical effects have been attributed to an impurity in the manufactured acid.

If any benefit is to be derived from salicylic acid in acute articular rheumatism, it must be used early in the disease and in heroic doses at comparatively frequent intervals—not less than 20 grains (1.3 Gm.) every two, three, or four hours for an adult. If too serious gastric and cerebral symptoms manifest themselves, the drug may be decreased in amount or discontinued until the unpleasant action subsides.

It is better, except in acute articular rheumatism, to give a small dose, repeated frequently, than to administer a full dose at once.

The physiological action and therapeutics of LITHIUM SALICYLATE are practically the same as those of salicylic acid or sodium salicylate. It is, however, richer in salicylic acid than the sodium salt, and in *gout* and *chronic rheumatism* has been found to be of more value than salicylic acid.

It should be given in solution.

SODIUM SALICYLATE is identical in physiological action and

uses with salicylic acid, with the exception that it is less irritating to the stomach, and is therefore ordinarily to be preferred to the acid.

It may be prescribed in aromatic water, in syrup, or in powder, pills, or capsules.

Sălol—Sălol—Salol. *U. S. P.*

(Phenyl Salicylate.)

Origin.—The Salicylic Ether of Phenol, prepared by heating Salicylic Acid with Phenol in the presence of Phosphorus Pentachloride.

Description and Properties.—A white, crystalline powder, odorless, or having a faintly aromatic odor, and almost tasteless. Permanent in the air. Almost insoluble in water; soluble in 10 parts of alcohol; also in 0.3 part of ether, and readily in chloroform and in fixed or volatile oils.

Dose.—3–15 grains (0.19–1.0 Gm.).

Physiological Action.—*Externally and Locally.*—It is a more powerful antiseptic than either of its constituents. Nencki claims that it is not a germicide, as it will not destroy bacteria when present, although it prevents their formation. It is not, like salicylic acid, irritating to the mucous membranes.

Internally.—The action of salol is essentially like that of salicylic acid, but it is a more powerful antipyretic, analgesic, and cerebrospinal sedative. It reduces temperature much more promptly, the antipyretic action occurring within fifteen minutes after a full medicinal dose has been taken. The effect, however, is not prolonged, repeated doses being required to maintain the reduction of temperature.

The circulation is, perhaps, not so much depressed as by salicylic acid. The respirations are at first quite rapidly increased, and are rendered very shallow, requiring some time to resume their normal condition.

It is converted by the pancreatic and intestinal juices into its original constituents—salicylic acid and carbolic acid. It is usually absorbed and eliminated very rapidly, having been detected in the urine in the form of salicyluric acid and phenol-ether-sulphuric acid within thirty minutes after its ingestion by the stomach. To the latter acid is due the dark, smoky color of the urine which sometimes exists under large or continued doses of salol.

Therapeutics.—*Externally and Locally.*—Salol is especially

recommended as an antiseptic dressing for *wounds, burns, venereal ulcers*, and *buboes*. Powdered salol or an ointment—1 part to 150 parts of petrolatum—has been used in cases of *tubercular laryngitis* and *ozena*. Like salicylic acid, it is also of value in *eczema* and *sycosis simplex*.

Internally.—It is an efficient remedy in all diseases benefited by the internal administration of salicylic acid. In addition to these services it is a valuable remedy in *acute* and *chronic cystitis, gonorrhea, intestinal catarrh*, especially *duodenal catarrh* and *catarrhal jaundice*, and to relieve the pains of *neuritis* and *myalgia*.

Salol is much more useful than salicylic acid in *diarrhea, cholera morbus*, and *cholera*, the latter disease yielding better, perhaps, to this remedy than to any other.

Administration.—It may be given in pills, capsules, powders, emulsion, or suspended in milk. The compressed tablets of this drug so extensively used at present are not recommended, owing to their slow and difficult solution.

Salicīnum—Salicīni—Salicin. *U. S. P.*

Origin.—A Glucosid obtained from several species of Salix (willow) and Populus (poplar).

Description and Properties.—Colorless or white, silky, shining, crystalline needles, or a crystalline powder, odorless and having a very bitter taste. Permanent in the air. Soluble in 28 parts of water, 30 parts of alcohol, 0.7 part of boiling water, and in 2 parts of boiling alcohol.

Dose.—10 grains–2 drachms (0.6–8.0 Gm.).

Physiological Action.—Its physiological effect is analogous to that of salicylic acid, but is much less active than the latter. It does not disturb digestion, but in moderate doses promotes appetite and acts like other bitters. It is more rapidly absorbed than salicylic acid, is partly decomposed, and is found in the urine, as salicin and salicylic acid, in from fifteen to thirty minutes after the ingestion of a single dose.

Therapeutics.—While inferior to salicylic acid in most respects, salicin is frequently used for the same purposes. It is superior to, and safer than, salicylic acid in *acute rheumatism* characterized by a weak heart and depressed vaso-motor system.

It is an excellent stomachic tonic, and may be used like other bitters in the treatment of *atonic dyspepsia* and other conditions benefited by this class of drugs.

Contraindications.—In acute inflammatory affections of the brain and ear.

Administration.—Salicin may be administered in powders, capsules, or solution. Owing, however, to its bulk and intensely bitter taste, it is perhaps best given in suspension in the aromatic elixir of liquorice or in syrup of yerba santa.

Naphtalīnum—Naphtalīni—Naphtalin. *U. S. P.*

Origin.—A hydrocarbon obtained from coal-tar.

Description and Properties.—Colorless, shining, transparent laminæ, having a strong, characteristic odor resembling that of coal-tar, and a burning, aromatic taste; slowly volatilized on exposure to air. Insoluble in water, but when boiled in it imparting a faint odor and taste. Soluble in 15 parts of alcohol, and very soluble in boiling alcohol; also very soluble in ether, chloroform, carbon disulphide, and in fixed or volatile oils. Naphtalin volatilizes slowly at ordinary temperatures, but rapidly when heated. Its vapor is inflammable, burning with a luminous and smoky flame. It should be kept in well-stoppered bottles.

Dose.—2–10 grains (0.12–0.6 Gm.).

Năphtol—Năphtol—Naphtol. *U. S. P.*

(Beta-naphtol.)

Origin.—A phenol occurring in coal-tar, but usually prepared artificially from naphtalin.

Description and Properties.—Colorless or pale buff-colored, shining, crystalline laminæ, or a white or yellowish-white crystalline powder, having a faint, phenol-like odor, and a sharp, pungent, but not persistent taste. Permanent in the air. Soluble in about 1000 parts of water, in 0.75 part of alcohol, in about 75 parts of boiling water, and very soluble in boiling alcohol, ether, chloroform, and solutions of caustic alkalies. It should be kept in dark amber-colored, well-stoppered bottles.

Dose.—2–10 grains (0.12–0.6 Gm.).

Allied Compounds.

Alūmnol.—An almost colorless, non-hygroscopic powder; readily soluble in cold water or glycerin, less soluble in alcohol, and insoluble in ether. It is employed as a local remedy in solutions varying in strength from 1 to 50 per cent. Used externally.

Ăsaprol.—A colorless, neutral crystalline powder, soluble in 1½ parts of water and in 3 parts of alcohol.—*Dose*, 15–60 grains (1.0–4.0 Gm.).

Benzonăphtol.—Obtained by the action of Benzoic Chloride on Beta-naphtol in a

sand-bath. It is an odorless, tasteless, white, crystalline powder, or occurs in the form of long needles. Insoluble in cold water. *Dose*, 4–8 grains (0.18–0.5 Gm.).

Bētol (Naphtosālol—Salinăphtol).—A substance analogous to salol, and prepared in the same manner, except that sodium-naphtol is used instead of sodium-phenol. It occurs as a colorless, odorless, tasteless, lustrous crystalline powder. Insoluble in water or glycerin, and with difficulty soluble in cold alcohol. *Dose*, 2–5 grains (0.12–0.3 Gm.).

Camphorated Năphtol.—Obtained by mixing 1 part of Beta-naphtol with 2 parts of Camphor. It is a brownish, transparent, syrupy liquid.

Hydronăphtol.—A derivative of beta-naphtol, obtained by the action of reducing agents. It occurs in scale-like crystals, of a silvery white or grayish hue, of slightly aromatic odor and taste. Soluble in 1100 parts of water, and freely soluble in alcohol, ether, glycerin, benzene, chloroform, and fixed oils. *Dose*, 2–3 grains (0.12–0.18 Gm.).

Antagonists and Incompatibles.—Physiological antagonists of NAPHTALIN are the same as for other members of this group. NAPHTOL is incompatible with subacetate of lead.

Synergists.—Carbolic acid and its derivatives.

Physiological Action.—NAPHTALIN is antiseptic, antifermentative, disinfectant, and deodorant. Its action is quite similar to salol, it being insoluble in the gastric juices but to some extent soluble in the intestines, where it acts as an antiseptic by local contact, deodorizing the stools and often imparting to them its own odor. It is absorbed to some extent, and is eliminated by the lungs and kidneys, but escapes principally in the feces. It is broken up into naphtol or phenol, and acts as a local antiseptic and disinfectant at points of elimination, but does not occasion any local irritation unless quite large doses have been taken: "15 grains (1.0 Gm.) daily have occasioned frequent micturition, with burning pain, vesical tenesmus, and redness of the urethral orifice." Purdy states that in certain cases of genito-urinary disease he has known a dose of 5 grains (0.32 Gm.) to cause severe suffering along the whole urinary tract. It is a stimulant expectorant, and differs from other members of the group in that it possesses no antipyretic action.

NAPHTOL is quickly absorbed when applied locally. It produces considerable irritation when used in solution, but has no irritating effect when applied in the form of ointment. Toxic effects may result from its absorption by the skin, their character resembling the action of carbolic acid.

Alŭmnol.—An astringent antiseptic.

Ăsaprol.—An antipyretic, analgesic, and antiseptic. It is considered superior to the salicylates in these respects, having the advantage of neither exciting vomiting nor disturbing the brain or the auditory apparatus.

Benzonăphtol.—Antiseptic, diuretic, and but slightly poisonous.

Bētol.—Action almost identical with that of salol.

Hydronăphtol.—A powerful non-irritating, non-corrosive, and non-poisonous antiseptic, said by Dr. Fowler to possess "antiseptic properties fifteen times greater than carbolic acid."[1] Dr. Levis claims that it is thirty times as antiseptic as salicylic acid and that this property exceeds that of boric acid sixty times, of alcohol six hundred times, and that in this respect it ranks next to mercuric chloride.

Therapeutics.—*Externally and Locally.*—NAPHTALIN in alcoholic solution is advised by Henri Laserre in the treatment of *chronic abscesses* and *adenitis*. It is also recommended in the treatment of *scabies* and other *parasitic skin diseases*.

Internally.—It is used in *typhoid fever* and in the *gastro-intestinal* and *genito-urinary disorders* for which salol and carbolic acid are administered, such as *chronic diarrhea* and *dysentery*, *acute* or *chronic cystitis*, etc.

The internal uses of NAPHTOL are the same as those of naphtalin, while externally it may be employed, like carbolic acid or creasote, as a general antiseptic in *cutaneous disorders*, whether organic or parasitic.

Alŭmnol.—An efficient remedy in many *acute* and *chronic inflammatory diseases of the skin*, and in *gonorrhea*, *chancres*, *syphilitic ulcers*, *balanitis*, etc. A 1 per cent. solution may be injected in gonorrhea, while stronger solutions (10–50 per cent.), or alumnol plaster, are recommended in *chronic diseases of the skin*.

Ăsaprol.—Given for the same purposes as salicylic acid and the salicylates, although it is not so uniformly successful in *acute articular rheumatism*, while having the advantage of causing less heart-depression.

Bētol.—Used chiefly in the *bowel complaints of children*. It may be administered either by the mouth or through the rectum, associated with bismuth or antacids. It has been used also in *acute articular rheumatism* and *bladder affections*.

Camphorated năphtol is considered by some practitioners to be superior to all other remedies to prevent suppuration in *acute tonsillitis*.

Fernet has employed it successfully in *tubercular ulcerations of the tongue*, while Reboul of Marseilles and others have adopted it with good effect hypodermically in *tuberculous adenitis* and *tuberculosis of the testis*. It has also been used in *tuberculosis of the bladder*, *joints*, etc.

Ruault claims it to be an efficient local application to the turbinated bones in *ozena*.

Hydronăphtol.—Considered by many physicians to be superior to carbolic acid, since it is without disagreeable odor and can be used without exciting irritation or danger of toxic impression.

Dockrell employs it in the form of a plaster for destroying the trichophyton fungus of *tinea tonsurans*, and believes it to be superior to mercuric chloride as a germicide.

It has been used as a preventive of *dental caries*, and in the treatment of *gingivitis*, *pyorrhœa alveolaris*, *diphtheria*, etc.

Internally it has been recommended in *dysentery*, *diarrhea*, *pulmonary tuberculosis*, and *typhoid fever*.

[1] *New York Med. Journ.*, Oct. 3, 1885.

Contraindications.—These preparations should not be given internally when the functional activity of the kidneys is defective.

Administration.—NAPHTALIN is best given internally in the form of pills or in capsules. When it is necessary to use it topically, the offensive odor of the drug may be disguised, it is said, by triturating it with a small quantity of the oil of bergamot. NAPHTOL should be given in capsules, in the dose recommended, three times a day or oftener if necessary.

ASAPROL, BETOL, and HYDRONAPHTOL are best given in capsules, although betol, which is tasteless and insoluble in water, may be administered in the form of powders.

Resorcīnum—Resorcīni—Resorcin. *U. S. P.*

Origin.—Prepared by melting Galbanum, Ammoniac, or Guaiacum Resin with Potassa. It is also prepared in a similar manner from Asafetida, Sagapenum, Ascaroid Resin, and from Phenolsulphonic Acid and other derivatives of Phenol.

Description and Properties.—Colorless or faintly reddish, needle-shaped crystals, or rhombic plates, having a faint, peculiar odor, and a disagreeable sweetish and afterward pungent taste. Resorcin acquires a reddish or brownish tint by exposure to light and air, and should be kept in dark amber-colored vials. It is soluble in 0.6 part of water, 0.5 part of alcohol, very soluble in boiling water and in boiling alcohol, readily soluble in ether and in glycerin, and very slightly soluble in chloroform. The aqueous solution is neutral or only faintly acid to litmus-paper.

Dose.—3–8 grains (0.2–0.5 Gm.).

Allied and Derivative Compounds.

Hydroquīnol—Hydroquīnone—Hydrochīnone—Paradioxybĕnzene.—Colorless, odorless, dimorphous crystals, having a sweetish taste. Soluble in 17 parts of water, and very soluble in hot water, alcohol, and ether. *Dose*, 1½–5 grains (0.03–0.30 Gm.).

Catĕchol—Pyrocatĕchin—Orthodioxybĕnzene.—Acicular crystals, readily soluble in water, alcohol, and ether.

Other allied compounds are—**Thioresorcin, Resopyrine,** and **Fluorescein.**

Antagonists.—Cerebral excitants, cardiac and respiratory stimulants.

Synergists.—Salicylic acid, quinine, carbolic acid.

Physiological Action.—*Externally and Locally.*—Resorcin is an antiferment, antiseptic, deodorant, a feeble analgesic, and a parasiticide. Applied to the unbroken skin, it is non-irritating, is not ab-

sorbed by it, and when injected into the subcutaneous tissues produces but little irritation, with no suppuration. Applied to the moistened mucous membrane, its action is similar to that of carbolic acid, producing vesication, etc.

Internally.—The physiological properties of resorcin are allied to those of carbolic acid. It possesses more marked antipyretic and diaphoretic actions than carbolic acid, but when used to produce these effects it greatly depresses the heart.

Its chief action is on the nervous system, which it first powerfully stimulates and then depresses.

It is mainly and rapidly eliminated by the urine, which it colors an olive-green or bluish-violet hue.

Poisoning.—Poisonous doses produce vertigo, ringing in the ears, deafness, disturbance of vision, weak, rapid, and irregular pulse, respiration at first convulsive and jerking, afterward accelerated, shallow, and weak, death resulting finally from respiratory failure. There are great mental anxiety, epileptiform convulsions, collapse, and unconsciousness. Just before death there is a rise in temperature, doubtless due to excessive muscular action, although the temperature may fall below normal if there is quiet narcosis, as there may be in some instances.

Treatment of Poisoning.—Hypodermic injections of atropine. The administration of diffusible stimulants. Artificial respiration.

Therapeutics.—*Externally and Locally.*—Resorcin is especially useful in certain subacute or chronic skin affections, and may be used like salicylic acid in *indurated eczema.* It is of great value in *psoriasis, seborrhœa sicca, pityriasis capitis, sycosis, acne rosacea,* etc.

A 5 to 10 per cent. solution is an efficient application in *pharyngitis, diphtheria,* and *ulcerative laryngitis.* An ointment of resorcin is an excellent application to *foul ulcers, sloughing wounds,* and *syphilitic ulcers.*

Condylomata have been cured by dusting upon them powdered resorcin.

A mixture of powdered resorcin and boric acid (1 : 20 or 1 : 10) has been used with brilliant results in *suppuration of the middle ear.*

A 2 per cent. solution has been found useful in the form of a spray in *whooping cough,* while stronger solutions of 10 or 20 per cent. have been used with some success in *hay fever.*

Soluti[illegible] resorcin have been used in *gonorrhea* and *cystitis.*

[illegible]cin is preferable to carbolic acid for internal

[illegible] in digestive disorders such as *gastralgia,*

chronic gastritis, ulcer of the stomach, and *fermentative dyspepsia,* so called. Owing to its sedative and antifermentative properties, it is of value in *acute diarrhea* of children.

It has been used with some success in *intermittent fever,* but not with good results sufficiently uniform to justify the exclusion of quinine. As an antipyretic it may be used when a drug of that character is indicated, but it is not equal to antipyrine or acetanilid, and in doses sufficient to produce the desired reduction of temperature it is too depressant to the heart. Its chief therapeutic value is for external or local use, and internally for the digestive disorders above mentioned.

Administration.—It should be given in pills or capsules.

Ichthȳolum—Ichthȳoli—Ichthyol. (Unofficial.)

Origin.—It is obtained by the destructive distillation of bituminous rock found near Seefeld in the Tyrolese Alps, which contains enormous quantities of semi-fossilized fishes and marine animals.

Description and Properties.—It occurs in the form of a brownish-yellow, transparent, oily liquid, containing about 10 per cent. of sulphur.

Upon being treated with concentrated sulphuric acid ichthyol is converted into ichthyol-sulphonic acid, which readily combines with ammonia and other alkalies, as well as with lithium, zinc, mercury, etc., forming the ammonium ichthyol, sodium ichthyol, zinc ichthyol, etc.

Ammonium ichthyol occurs as a clear reddish-brown, syrupy liquid with a bituminous odor and taste. Soluble in water and in a mixture of equal volumes of ether and alcohol.

Dose.—2–10 minims (0.12–0.6 Cc.).

The other salts of ichthyol-sulphonic acid occur as brownish or black tar-like masses, the sodium salt being the most important, as it is the one most employed when ichthyol is desirable in pill form.

Dose.—Sodium ichthyol, 2–4 grains (0.1–0.25 Gm.).

Allied Drugs.

Thiolum—Thioli—Thiol.—*Origin.*—This substance is prepared by heating brown-colored paraffin or gas oils with Sulphur, and extracting the sulphurated, unsaturated hydrocarbons with Alcohol.

Description and Properties.—It occurs as a neutral, solid body, non-hygroscopic and soluble in water, and of a dark-brown color, or in the form of a dark reddish-brown, syrupy liquid, containing about 40 per cent. of thiol.

Dose.—½–1 grain (0.03–0.06 Gm.).

Tumenōlum—Tumenōli—Tumenol.—*Origin.*—It is obtained from purified mineral oils by the direct action of concentrated sulphuric acid, without previous sulphuration, being a mixture of sulphones and sulphonic acids.

Description and Properties.—A dark-brown or blackish-brown liquid of a syrupy consistency.

Dose.—It is used only externally, in strengths of from 5 to 10 per cent.

Antagonists and Incompatibles.—Ichthyol possesses marked reducing properties, and should not therefore be combined with substances, like potassium permanganate, which part readily with oxygen.

Synergists.—Most members of this group, particularly the tars, carbolic acid, creasote, etc., aid its action.

Physiological Action.—*Externally and Locally.*—ICHTHYOL is ischemic, sedative, parasiticide, and possesses antiseptic and probably disinfectant properties.

When applied to the skin in full strength it produces some irritation. It is readily absorbed, having the power to penetrate the skin, affecting the deeper tissues beneath.

Internally.—Digestive System.—Very large doses produce considerable gastro-intestinal irritation.

Circulatory System.—It has the power in medicinal doses of contracting the caliber of the arteries, and in large doses it increases the migration of the white blood-corpuscles.

The physiological action has not been fully studied, and it is not yet positively known what action it has upon the nervous and respiratory systems and upon temperature.

Therapeutics.—*Externally and Locally.*—ICHTHYOL was introduced by Unna as a valuable remedy in certain diseases of the skin. It is particularly useful in *erythematous eczema, erysipelas, lupus erythematosus, irritable acne*, and certain forms of *acne rosacea.*

Agnew has employed it with advantage in *lymphatic enlargements.* It has also been found useful in *synovial inflammations, inflammatory conditions of the female genital organs*, and in certain diseases of the *ear* and *nose.*

THIOL, although inferior, is similar to ichthyol in its therapeutic action. It has been found to be valuable in the treatment of *herpes zoster, dermatitis herpetiformis*, and *erythema multiforme.*

Administration.—Ichthyol, when given internally, should be dispensed in capsules, while thiol may be given in capsules, pills, or wine.

Externally, ichthyol may be employed in solution, dissolved in

chloroform or in a mixture of alcohol and ether, and applied with a brush; or in the form of an ointment mixed with soft petrolatum or lanolin in from 1–4 to 8 drachms (4.0–15.0 Cc. to 32.0 Gm.). It is used also in the form of a soap in from 5 to 20 per cent. strength.

Thiol is used locally in powder form, or as an ointment of 5 to 10 per cent. of the liquid, or in collodion containing 5 per cent. of the powder, or in solutions of glycerin and aqueous solutions containing from 5 to 50 per cent. of the powder.

Iodofŏrmum—Iodofŏrmi—Iodoform. *U. S. P.*

Origin.—It is obtained by the action of Iodine, in the presence of fixed alkalies or alkali carbonates, upon Alcohol or Acetic and other easily-saponifiable Ethers.

Description and Properties.—Small, lemon-yellow, lustrous crystals, of the hexagonal system, having a peculiar, very penetrating, and persistent odor, somewhat resembling that of saffron and iodine, and an unpleasant, slightly sweetish, and iodine-like taste. It is very slightly soluble in water, to which, however, it imparts its odor and taste; soluble in about 52 parts of alcohol, in about 12 parts of boiling alcohol, or in 5.2 parts of ether, and very soluble in chloroform, benzin, and fixed and volatile oils.

Iodoform is slightly volatile, even at ordinary temperatures, and in boiling water distils slowly over with its vapor. It should be kept in well-stoppered bottles, in a cool and dark place.

Iodoform contains 96.69 per cent. of its weight as iodine.

Dose.—1–3 grains (0.06–0.2 Gm.).

Official Preparation.

Unguĕntum Iodofŏrmi—Unguĕnti Iodofŏrmi—Ointment of Iodoform.—10 per cent. Used externally.

Allied Compounds.

Antisĕptol—Cinchonine Iodosulphate.—*Origin.*—It is prepared by mixing an aqueous solution of Cinchonine Sulphate with an aqueous solution of Iodine and Potassium Iodide, and washing and drying the resulting precipitate.

Description and Properties.—It occurs as a light reddish-brown powder, insoluble in water, but soluble in alcohol and chloroform. It contains about 50 per cent. of iodine.

Dose.—1–3 grains (0.06–0.2 Gm.).

Aristol—Dithymol Di-iodide.—*Origin.*—It is obtained by adding a solution of iodated Iodide of Potassium to an aqueous solution of Hydrate of Sodium containing *thymol*. The resulting precipitate is washed and subsequently dried at ordinary temperature.

Description and Properties.—A dark, brownish-red, amorphous, almost tasteless powder, of a slight, peculiar, iodine-like odor, insoluble in water and glycerin, sparingly

soluble in alcohol, but readily soluble in ether, collodion, and chloroform. It is also taken up by fixed oils, petrolatum, etc.

Aristol is decomposed by heat and light, and it should be kept in dark amber-colored, well-stoppered bottles. It contains 45.8 per cent. of iodine.

Dose.—It is not given internally.

Eūrophen.—Prepared in a manner analogous to that of preparing aristol, except that isobutylorthocresol is used in place of thymol.

Description and Properties.—An amorphous, yellow powder, having an odor resembling saffron; soluble in ether, chloroform, and fixed oils; insoluble in water and glycerin. It is permanent in dry air, but when moistened with water resolves into iodine, forming a new soluble iodine compound. When heated to 110° C. (230° F.) it melts, forming a clear brown liquid. It contains 27.6 per cent. of iodine.

Dose.—¼–1½ grains (0.016–0.09 Gm.). It is used hypodermically in olive oil, and externally in the form of an ointment, in strengths varying from 3 to 10 per cent.

Antagonists and Incompatibles.—It is incompatible with the preparations of mercury and zinc, with metallic oxides, and with starch.

Īodol.—*Origin.*—Obtained by the interaction of Iodine and Pyrrol (a constituent of mineral oil) in Alcoholic Solution for twenty-four hours, the iodol being precipitated upon the addition of Water; or it may be prepared after the manner of preparing aristol, except that Pyrrol is used instead of Thymol.

Description and Properties.—It is a pale-yellow or grayish-brown, more or less crystalline, bulky, tasteless, and odorless powder. It is insoluble in water, and but slightly soluble in diluted alcohol. It is soluble in alcohol and ether. The alcoholic solution is miscible with glycerin, but when mixed with water a milky precipitate is formed. Iodol contains 88.97 per cent. of iodine.

Dose.—1½–2 grains (0.03–0.12 Gm.).

Lŏsophene.—*Origin.*—Prepared by slowly adding an aqueous solution of Iodine and Iodide of Potassium to an aqueous solution of Ortho-oxyparatoluic Acid and Sodium Bicarbonate. The precipitate formed is washed with Water and recrystallized from Alcohol.

Description and Properties.—It occurs as colorless, odorless, needle-shaped crystals. Insoluble in water and alcohol, but readily soluble in ether, benzene, chloroform, and fixed oils. It contains 78.39 per cent. of iodine.

Dose.—It is used externally.

Sozoĭodol.—*Origin.*—A combination of Iodine 54 per cent., Carbolic Acid 20 per cent., and Sulphur 7 per cent.

Description and Properties.—The sodium, potassium, ammonium, mercury, lead, and zinc salts of this acid are the preparations used, the sodium salt being the one most commonly employed. The *sodium sozoiodolate* occurs in bright, prismatic, needle-shaped crystals. Soluble in water, alcohol, and glycerin.

Dose.—For external use, in strengths varying from 3 to 20 per cent.

Sulphăminol.—*Origin.*—It is formed by the action of Sulphur on the salts of Meta-oxydiphenylamine.

Description and Properties.—It is a yellow powder, insoluble in water, readily soluble in alkalies, alcohol, and glacial acetic acid.

Dose.—1–4 grains (0.006–0.25 Gm.).

Antagonists and Incompatibles.—Iodoform is incompatible with mercuric chloride.

Physiological Action.—*Externally and Locally.*—Iodoform ordinarily possesses no irritating action when applied to the skin or

mucous membranes, or to ulcers and wounds. On the contrary, it possesses analgesic properties. It has a tendency to check serous oozing when applied to wounds.

Internally.—Digestive System.—Small doses, if they have any effect, slightly increase the appetite, and tend to increase the salivary, biliary, and intestinal secretions. Large doses disturb the stomach, and may occasion nausea, vomiting, and diarrhea.

Circulatory System.—Small doses retard and strengthen the pulse, and, for a brief period only, increase arterial tension. Full medicinal doses lessen arterial tension and render the pulse slower and weaker. Lethal doses rapidly accelerate the pulse, causing it to become irregular; later, the action of the heart is slowed, and finally arrested in diastole, from paralysis of the cardiac muscle.

Nervous System.—Large doses are apt to produce headache, restlessness, delirium, or stupor. The reflexes may be depressed, or in some cases choreic movements may appear. Muscular contractility and the excitability of the nerve-centers to external stimulation are lessened.

Respiratory System.—Very large doses produce convulsive respiratory movements.

Absorption and Elimination.—Iodoform is absorbed from the stomach, or from mucous membranes or wounds to which it is applied. It is slowly absorbed from the alimentary canal, but readily absorbed from wounds. In the tissues it combines with the proteid molecules, and is retained in the system as potassium iodide and other iodides. It is eliminated in all the secretions, and has been detected in the urine and saliva within one hour after its administration, traces of it being perceptible in the secretions for three days. Iodine is liberated at the points of elimination, either as an iodate or as some organic compound of iodine, or both. The drug is also detected in the breath, though it is chiefly eliminated in the urine as alkaline sodium iodate, coloring the urine yellow. It should be remembered that iodoform is absorbed much more rapidly than it is eliminated.

Temperature.—Large doses cause a rise of temperature, while poisonous doses may, at the last, produce a decided reduction of animal heat.

Untoward Action.—Sometimes iodoform excites an eczematous eruption, which may be papular or erythematous, and symptoms of vertigo. Muscular weakness and double vision have also been observed; sleepiness, alternating with excitement; incoherence of speech; headache; mental confusion; and amblyopia.

Poisoning.—Three forms of poisoning by iodoform are described by Duret—the eruptive, the cerebral, and the syncopal.

In the first of these there may be a severe and extensive erythema or eczematous eruption. The cerebral variety is characterized by rapid increase of temperature and accelerated pulse—as high as 150 or 175 per minute; great irritation of the gastro-intestinal tract; widely dilated, or motionless and contracted, pupils; intense headache over the entire circumference of the head; melancholia; great depression of spirits; hallucinations and active delirium or suicidal mania.

In the syncopal variety the patient complains of dizziness and mental confusion; is languid and weak; the heart's action becomes very rapid and feeble, the patient passing at length into a lethargic or comatose condition, with paralysis of the sphincters, and finally dying, perhaps quite suddenly.

The symptoms of poisoning may appear soon after the application of the drug, or they may be deferred for days and even weeks. In the latter case, which may properly be termed chronic poisoning, the patient is more apt to be melancholy, weak, and apathetic, with slight fever and accelerated pulse. Old people are the more susceptible to its toxic influence.

Treatment of Poisoning.—Every particle of the drug should be immediately removed from the body or its internal administration be discontinued at once. Stimulants, diaphoretics, and diuretics should be given, with frequent bathing of the body in warm water, to hasten elimination. Opium and large doses of potassium bicarbonate have been recommended.

Therapeutics.—*Externally and Locally.*—IODOFORM acts as an alterative, analgesic, protectant, antiseptic, and germicide to at least some forms of bacilli. It is therefore one of the best applications to *wounds*, *ulcers*, etc. It is especially valuable in the treatment of *tubercular affections*, such as *tubercular joints*, when it is used in the form of an injection—10 to 20 per cent.—in sterilized olive oil. In *tubercular parenchymatous synovitis* the mixture is injected directly into the joint-cavity. Rinonapoli recommends a 10 per cent. ethereal solution in *malignant pustule*, injected hypodermically into the base of the tumor; while Terrier and Mosetig von Moorhof have both used it successfully in parenchymatous *goiter*.

Iodoform is an exceedingly valuable application to *syphilitic ulcers*, *chancres*, *chancroids*, *suppurating buboes*, *ulcerations of the uterus*, *uterine cancer*, and *indolent* and *irritable ulcerations of the leg*.

Incorporated in a suppository, it is very efficacious in painful *hemorrhoids*, *fistula*, and *fissure of the anus*.

It is a valuable application in many diseases of the *ear*, *nose*, *throat*, *eye*, and *skin* where a drug of this character is indicated.

Internally.—IODOFORM is used but very little internally, although it has been employed in *phthisis*, *hemoptysis*, *syphilis*, *catarrhal jaundice*, *hepatic cirrhosis*, *gastric catarrh*, *diabetes*, and as an intestinal antiseptic.

The allied compounds mentioned above are used locally as substitutes for iodoform. Most of them possess the great advantage of being odorless, and some of them seem to be in all respects quite as efficient as iodoform. ARISTOL is undoubtedly superior to it in the treatment of *indolent ulcers* and in many *diseases* of the *skin*, *ear*, *nose*, and *throat*. EUROPHEN and IODOL should certainly replace iodoform in many cases.

Administration.—Internally, iodoform should be given in pills or capsules. Externally, it may be used in the form of a powder, alone or mixed with powdered borax or boric acid. It is also used in the form of an ointment or collodion. It is given hypodermically, mixed with olive oil and glycerin, or dissolved in ether, in strengths varying from 10 to 30 per cent.

Its disagreeable odor may be modified or disguised by mixing it with tar, liquid styrax, balsam of Peru, thymol, coumarin, menthol, ground coffee, oil of lavender, bergamot, bitter almond, coriander, musk, vanilla, or some similar aromatic and pleasantly odorous substance.

Benzoïnum—Benzoïni—Benzoin. *U. S. P.*

Origin.—A balsamic resin obtained from *Styrax Benzoin* Dryander, a large tree indigenous in Sumatra and Java, and probably also in Cochin China and Siam.

Description and Properties.—Benzoin exudes from incisions in the bark, and upon exposure to the air hardens into lumps consisting of agglutinated, yellowish-brown tears, which are internally milk-white, or in the form of a reddish-brown mass, more or less mottled from whitish tears imbedded in it. It is almost wholly soluble in 5 parts of moderately warm alcohol and in solutions of the fixed alkalies. When heated it gives off fumes of benzoic acid. It has an agreeable balsamic odor and a slight aromatic taste.

Benzoin is of the nature of a balsam, containing from 20 to 24 per cent. of *benzoic acid*, resin, and volatile oil. Some varieties

contain cinnamic acid, which is undesirable, while the benzoin from Siam contains vanillin and possesses the odor of vanilla.

Dose.—Benzoin is never administered in substance.

Official Preparations.

Adeps Benzoinātus—Ădipis Benzoināti—Benzoinated Lard (2 per cent.).—For external use.

Tinctūra Benzoīni—Tinctūræ Benzoīni—Tincture of Benzoin.—*Dose*, 30 minims to 1 fluidrachm (2.0–4.0 Cc.).

Tinctūra Benzoīni Compŏsita—Tinctūræ Benzoīni Compŏsitæ—Compound Tincture of Benzoin.—Benzoin, 12; Aloes, 2; Storax, 8; Tolu, 4; Alcohol, 74 parts. *Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Antagonists and Incompatibles.—The tincture and compound tincture are incompatible with aqueous preparations, the benzoin and other resins and balsams being precipitated from their alcoholic solutions by water.

Physiological Action.—The action of benzoin is due to the benzoic acid which it contains, and will therefore be considered under *Benzoic Acid.*

Ăcidum Benzōicum—Ăcidi Benzōici—Benzoic Acid. *U. S. P.*

Origin.—An organic acid usually obtained from Benzoin by sublimation, or prepared artificially, chiefly from Toluol.

Description and Properties.—White or yellowish-white lustrous scales or friable scales, having a slight characteristic odor resembling that of benzoin, and of a warm, acid taste; somewhat volatile at a moderately warm temperature, and rendered darker by exposure to light. Soluble when pure in about 500 parts of water, in 2 parts of alcohol at about 15° C. (59° F.), in 15 parts of boiling water, and in 1 part of boiling alcohol. It is also soluble in 3 parts of ether, 7 parts of chloroform, and readily soluble in carbon disulphide, in benzol, and in fixed and volatile oils. Sparingly soluble in benzin.

Benzoic acid has an acid reaction and is inflammable. It should be kept in dark amber-colored, well-stoppered bottles and in a cool place.

Dose.—5–15 grains (0.3–1.0 Gm.).

Ammōnii Bĕnzoas—Ammōnii Benzoātis—Ammonium Benzoate. *U. S. P.*

Origin.—Dissolve Benzoic Acid in Water of Ammonia and Distilled Water, evaporate, and crystallize.

Description and Properties.—Thin, white, four-sided laminar crystals; odorless, or having a slight odor of benzoic acid; a saline, bitter, afterward slightly acrid taste, and gradually losing ammonia on exposure to air. Soluble, at 15° C. (59° F.), in 5 parts of water, in 28 parts of alcohol, in 1.2 parts of boiling water, and in 7.6 parts of boiling alcohol. The salt is neutral or has a very slight reaction upon litmus-paper. It should be kept in well-stoppered bottles.

Dose.—10–20 grains (0.6–1.2 Gm.).

Lĭthii Bĕnzoas—Lĭthii Benzoātis—Lithium Benzoate. *U. S. P.*

Origin.—Prepared by decomposing Lithium Carbonate with Benzoic Acid.

Description and Properties.—A light white powder, or small, shining, crystalline scales; odorless or of a faint, benzoin-like odor, and of a cooling, sweetish taste; permanent in the air. Soluble in 4 parts of water, in 12 parts of alcohol, in 2.5 parts of boiling water, and in 10 parts of boiling alcohol. The presence of sodium benzoate increases the solubility in water and lessens it in alcohol. The aqueous solution (1 in 20) of lithium benzoate has a faintly acid reaction upon litmus.

Dose.—5–20 grains (0.3–1.2 Gm.).

Sōdii Bĕnzoas—Sōdii Benzoātis—Sodium Benzoate. *U. S. P.*

Origin.—Prepared by decomposing Sodium Carbonate with Benzoic Acid.

Description and Properties.—A white amorphous powder, odorless or having a faint odor of benzoin and a sweetish, astringent taste. Soluble in 1.8 parts of water, in 45 parts of alcohol, in 1.3 parts of boiling water, and in 20 parts of boiling alcohol. The aqueous solution is neutral to litmus-paper. It is efflorescent, and should be kept in well-stoppered bottles.

Dose.—5–30 grains (0.3–2.0 Gm.).

Allied and Unofficial Preparations.

Bismūthi Bĕnzoas—Bismūthi Benzoātis—Benzoate of Bismuth.

Mĕnthol Bĕnzoas—Mĕnthol Benzoātis—Benzoate of Menthol.—For external use.

Antagonists and Incompatibles.—BENZOIC ACID is incompatible

with the alkaline salts, as those of sodium, etc., and AMMONIUM BENZOATE is incompatible with the ferric salts.

Physiological Action.—*Externally.*—When applied in concentrated form to the skin or mucous membrane BENZOIC ACID is an irritant, and produces a catarrhal condition of the bronchial mucous membrane when its vapors are inhaled. It is a powerful antiseptic and germicide, preventing the growth of putrefactive bacteria in a solution of 1 : 1000.

Internally.—Digestive System.—In full medicinal doses BENZOIC ACID irritates the throat and produces a sense of heat in the epigastrium. Very large doses may occasion gastric inflammation, with nausea and vomiting. The functional activity of the liver is stimulated by sodium benzoate.

Circulatory System.—In large doses BENZOIC ACID increases the pulse-rate to a marked extent, and is a stimulant to the entire circulatory apparatus.

Respiratory System.—It is a powerful stimulant in moderate medicinal doses, increasing the respiratory movements and promoting the bronchial secretion.

Absorption and Elimination.—It is eliminated chiefly by the kidneys, but also by the skin, salivary glands, and broncho-pulmonary mucous membrane.

The important action of BENZOIC ACID is the change it undergoes in the kidneys, being converted into hippuric acid, in combination with glycocoll. This change takes place only in the kidneys, and the hippuric acid formed renders alkaline urine acid, besides increasing the urinary flow and disinfecting and stimulating the genito-urinary tract.

Temperature.—Like other members of this group, the acid, as well as its salts, possesses antipyretic properties, many observers holding it to be equal, if not superior, to salicylic acid in this respect. It is not yet known in what manner it reduces temperature.

Untoward Action.—BENZOIC ACID sometimes produces urticaria or an erythematous condition of the skin.

Therapeutics.—*Externally and Locally.*—The COMPOUND TINCTURE OF BENZOIN is an admirable preparation for many conditions requiring antiseptic, astringent, and stimulating dressing. It is frequently applied to *cutaneous wounds*, the alcohol evaporating and leaving upon the injured parts a protective film of balsams. A piece of lint or absorbent cotton saturated with the compound

tincture has been used to close the punctures in the skin after tenotomy.

Stillé recommends a combination of the compound tincture of benzoin and glycerin for the treatment of *chapped hands* and *lips*, *frost-bite*, and *fissured* and *chapped nipples*.

R. W. Taylor treats "*ringworm of the thighs*" by painting the affected part with a mixture of bichloride of mercury and compound tincture of benzoin, 2–5 grains to 1 ounce (0.12–03 to 30.0 Cc.).

The compound tincture, diluted with water in various proportions, makes an efficient application in *catarrhal affections of the pharynx* and *larynx*, either in the beginning of an inflammation or during the relaxed condition which so often accompanies the termination of an acute attack. The *hoarseness* of vocalists and public speakers, the result of excessive strain upon the vocal cords, is frequently relieved by this remedy.

Inhalations of BENZOIN are a popular and frequently effective method of treating *acute catarrhal inflammation* of the upper respiratory passages.

The *cough* and *expectoration* of *chronic bronchitis* and *chronic phthisis* are eased and lessened by inhaling night and morning a drachm (4 Gm.) of BENZOIC ACID, added to boiling water.

A preparation like the following is an efficient and agreeable lotion for irritative forms of *chronic nasal catarrh*:

℞. Sodii boratis, *aā.* ℥ij (60.0 Gm.);
Acidi benzoici, gr. x (0.6 Gm.).—M.
Fiat pulvis No. 1.

Sig. To half a tumblerful of water add hall a teaspoonful each of the powder and glycerin. Use freely as a lotion.

The simple TINCTURE OF BENZOIN is an excellent application to *spongy gums*. There is much evidence of the efficiency of BISMUTH BENZOATE as a dressing for chronic or sloughing *ulcers*. *Specific sores*, *chancroids* and *chancres* especially, are well treated by dusting the parts with the benzoate after thoroughly bathing the surface with a weak solution of bichloride of mercury.

Probably the most important therapeutic action of BENZOIC ACID is shown in the treatment of *cystitis* and *pyelitis* accompanied by decomposing and alkaline urine.

The uric-acid diathesis is modified by this drug and its preparations, particularly by the LITHIUM BENZOATE. Phosphatic *calculi*

may be dissolved by the prolonged administration of AMMONII BENZOATE, which is preferable to benzoic acid for this purpose. *Incontinence of urine*, if due simply to the alkalinity of the urine, is relieved by the same remedy.

Liégeois has employed SODIUM BENZOATE as a *cholagogue* with excellent results. He associates it with rhubarb. He also states that benzoate of sodium favorably modifies the pain of *pharyngitis*. Sodium benzoate is an excellent substitute for sodium salicylate, being especially useful in the *septic diseases*. It is equally powerful as an antiseptic and antipyretic, though slower in its action than sodium salicylate. Its effects, however, are more permanent, and innocuous.

Administration.—Benzoic acid is best administered in pill form or in capsules, with balsam of fir or Castile soap as an excipient. The soluble benzoates may be given in solution in some aromatic water or in compressed pills. The solution, however, is preferable, and the unpleasant taste may be well disguised by a little spirit of chloroform. When any of these preparations are given for their action upon the urinary tract, it may sometimes be advantageous to combine them with a urinary sedative, such as tincture of belladonna or hyoscyamus.

Mўrrha—Mўrrhæ—Myrrh. *U. S. P.*

Origin.—A gum-resin obtained from *Commiphora Myrrha* (Nees) Engler, a shrub or small tree "forming the chief underwood of the Arabian and African forests along the shores of the Red Sea."

Description and Properties.—Roundish, irregular tears or masses, dusty brownish-yellow or reddish-brown; fracture waxy, somewhat splintery, translucent on the edges, sometimes marked with whitish veins; odor balsamic; taste aromatic, bitter, and acrid. It contains 60 per cent. of *gum*, 35 per cent. of *resin*, and 3 or 4 per cent. of a *volatile oil* (myrrhol).

Dose.—5–30 grains (0.3–2.0 Gm.), in pills or emulsion.

Official Preparations.

Mistūra Fĕrri Compŏsita—Mistūræ Fĕrri Compŏsitæ—Compound Iron Mixture.—*Dose*, ½–2 fluidounces (15–60 Cc.).

Pĭlulæ Ăloes et Mўrrhæ—Pĭlulas (acc.) **Ăloes et Mўrrhæ—Pills of Aloes and Myrrh.**—*Dose*, 2 to 5 pills.

Tinctūra Ăloes et Mўrrhæ—Tinctūræ Ăloes et Mўrrhæ—Tinctures of Aloes and Myrrh (10 per cent.).—*Dose*, ½–2 fluidrachms (2–8 Cc.).

Tinctūra Mȳrrhæ—Tinctūræ Mȳrrhæ—Tincture of Myrrh (20 per cent.).—*Dose*, 15–60 minims (1–4 Cc.).

Physiological Action.—Myrrh is astringent, disinfectant, slightly antiseptic, and stimulant. Its action resembles that of the aromatics, stimulating the appetite and acting as a carminative, excessive doses causing nausea and vomiting. It increases the number of white blood-corpuscles, and is a stimulant to the circulation.

The drug is eliminated by the mucous membranes generally, augmenting and disinfecting their secretions. It possesses emmenagogue properties.

Therapeutics.—As a stimulant and astringent myrrh is serviceable as a mouth-wash in *ptyalism* and *spongy gums* and in *ozena*. It is useful as a gargle in *pharyngitis*, *relaxed throat*, etc., and as an injection in *leucorrhea*, the latter disease, as well as *cystitis*, being favorably influenced by the internal administration of the drug. It has been used internally, with considerable success, as a stimulant expectorant in *bronchorrhea* and *chronic bronchitis*, and as a stomachic in *atonic dyspepsia*.

Administration.—Myrrh may be given internally in the form of an emulsion or pills. The tincture, either in full strength or diluted, is chiefly employed externally.

Bălsamum Peruviānum—Bălsami Peruviāni—Balsam of Peru. *U. S. P.*

Origin.—A balsam obtained from *Toluifera Pareiræ* (Royle) Baillon, a tree growing in Brazil and near the west coast of South America.

Description and Properties.—A liquid having a syrupy consistence, free from stringency or stickiness, of a brownish-black color in bulk, reddish-brown and transparent in thin layers, of an agreeable, vanilla-like, somewhat smoky odor, and a bitter taste, leaving a persistent after-taste. On exposure to air it does not become hard. It is completely soluble in 5 parts of alcohol.

The drug contains, among other substances, benzoic and cinnamic acids, cinnamein about 60 per cent., and resin 32 per cent.

Dose.—8–30 minims (0.5–1.84 Cc.).

Physiological Action.—Its properties are similar to those of myrrh, its action being almost analogous.

Therapeutics.—In various cutaneous disorders balsam of Peru is very efficient, being employed in *pruritus vulvæ*, *eczema*, *scabies*, *ringworm*, etc. It is remarkably efficacious as an application to

cracked nipples, cracked lips, indolent sores, bed-sores, etc., and is also serviceable in certain diseased conditions of the nose and throat, such as *atrophic rhinitis* and *tonsillar diphtheria*.

As a stimulant expectorant the drug is efficient in *chronic bronchitis*, being regarded by some physicians as of great service in *phthisis pulmonalis*. Like myrrh, balsam of Peru has been used to some extent as a stomachic carminative and tonic.

Administration.—It is best given in an emulsion or in glycerin.

Eucalyptus—Eucalypti—Eucalyptus. *U. S. P.*

Origin.—The leaves of *Eucalyptus globulus* Labillardière, collected from the older part of the tree. The *blue-gum tree* is a rapid grower, attaining a height of 200 to 300 feet (60–90 M.). It is native to Australia, but is cultivated in various portions of Europe, Africa, and the United States with the view of rendering malarial districts habitable by its antiseptic exhalations.

Description and Properties.—Petiolate, lanceolate, scythe-shaped, from 6 to 12 inches (15–30 Cm.) long, rounded below, tapering above, entire, leathery, grayish-green, glandular, feather-veined between the midrib and marginal veins; odor strongly camphoraceous; taste pungently aromatic and somewhat cooling, bitter, and astringent.

The most important constituent is a *volatile oil*, of which the leaves yield about 6 per cent.

Dose.—½–2 drachms (2.0–8.0 Gm.).

Official Preparation.

Extractum Eucalypti Fluidum—Extracti Eucalypti Fluidi—Fluid Extract of Eucalyptus.—*Dose*, 5–60 minims (0.3–4.0 Cc.).

Oleum Eucalypti—Olei Eucalypti—Oil of Eucalyptus. *U. S. P.*

Origin.—A volatile oil distilled from the fresh leaves of *Eucalyptus globulus* Labillardière, *E. oleosa* F. v. Müller, and some other species of the genus.

Description and Properties.—A colorless or faintly yellowish liquid, having a characteristic, aromatic, somewhat camphoraceous odor, and a pungent, spicy, and cooling taste. Soluble in all proportions in alcohol. This oil consists of two hydrocarbons (cymene and eucalyptene), terpene, and a substance upon which its medicinal value depends—*eucalyptol*. Oil of eucalyptus should b

kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—5–15 minims (0.3–1.0 Cc.).

Eucalŷptol—Eucalyptol—Eucalyptol. *U. S. P.*

Origin.—A neutral body obtained from the volatile oil of *Eucalyptus globulus.*

Description and Properties.—A colorless liquid, having a characteristic, aromatic, and distinctly camphoraceous odor, and a pungent, spicy, and cooling taste. Soluble in all proportions in alcohol.

Dose.—5–10 minims (0.3–0.6 Cc.).

Unofficial Preparations.

Āqua Eucalŷpti—Āquæ Eucalŷpti—Eucalyptus Water.—*Dose,* 2–4 fluidrachms (7.39–15.0 Cc.).

Tinctūra Eucalŷpti—Tinctūræ Eucalŷpti—Tincture of Eucalyptus.—*Dose,* 1–4 fluidrachms (3.7–15.0 Cc.).

Antagonists and Incompatibles.—Agents promoting waste antagonize the therapeutic action of eucalyptus. The chemical incompatibles are the mineral acids, mineral salts, and alkalies.

Synergists.—The vegetable bitters, aromatics, antispasmodics, turpentine, cubebs, and copaiba.

Physiological Action.—*Externally and Locally.*—Locally applied, the oil of eucalyptus and *eucalyptol* are more or less irritant, though perhaps less active than many volatile oils. In contact with mucous membranes or injected hypodermically, they cause pain, and, when swallowed, produce a burning sensation in the throat, stomach, and intestines.

If the vapor of eucalyptus be confined by preventing evaporation, vesication and pustulation result, the drug also acting as a rubefacient. Inhalation affects the bronchial mucous membrane unfavorably, the beneficial effects of the remedy residing in its properties as a powerful antiseptic and disinfectant. It is also slightly detergent and astringent.

Internally.—Digestive System.—Small doses, by stimulating the salivary and peptic glands, improve the appetite and digestion, while peristalsis is increased, the drug acting as a mild laxative. The ingestion of large amounts may occasion anorexia, nausea, vomiting, and perhaps diarrhea, although the drug cannot be considered an active emetic nor does it possess marked purgative properties.

Circulatory System.—Like quinine, eucalyptus arrests the ameboid movements of the white blood-corpuscles. It resembles that drug also in its reputed property of contracting the enlarged spleen. Medicinal doses of eucalyptol stimulate the heart, increasing the blood-pressure—probably the effect of reflex action from the stomach. The arterial tension, however, though at first raised, is subsequently reduced, the pulse, which under moderate amounts of the drug shows an increase in force and frequency, being lowered by immoderate dosage.

Nervous System.—Small doses stimulate mental activity. Frequent accompaniments of large doses are insomnia in the healthy and somnolence in debilitated subjects, and under certain conditions cerebral congestion, owing to the increased quantity of blood sent to the brain. Large or toxic doses are powerfully depressant to the brain, medulla, and spinal cord, abolishing the reflexes and at times occasioning loss of sensation in the lower limbs. "In large doses, after absorption, it seems to act chiefly on the nerve-centers, producing paralysis and death" (Hare).

Respiratory System.—The drug tends to accelerate the respiratory movements under small or moderate dosage; poisonous doses retard the breathing, finally arresting it, and causing death by paralysis of respiration.

Absorption and Elimination.—The drug acting as a marked diuretic, it is natural that elimination should take place largely by the kidneys. The skin, bowels, and bronchial mucous membrane share in the excretory process, the drug acting as a stimulant to the structures by which elimination takes place. A characteristic odor —resembling that of violets—is imparted to the urine, breath, and discharges from the bowels. Renal congestion, with pain in the region of the kidneys, is occasionally produced by very large doses of the drug.

Temperature.—Excessive doses result in a fall of temperature. According to Schläger, a thermal rise succeeds the hypodermic injection of the drug, due probably to local irritation.

Poisoning.—While fatal results from the ingestion of large doses are recorded, the toxic effects of eucalyptus are practically confined to the lower forms of animal and vegetable life—infusoria, cryptogamia, etc. In Gimbert's experiments upon animals it was noted that the heart continued to beat for some time after respiration had ceased; from which it may be concluded that, since the motor nerves and muscles retained their functional activity after death,

failure of mobility and reflex power is due to central action, the drug in toxic doses being a paralyzant to the spinal cord and the medulla.

Drowsiness, shallow breathing, cardiac weakness, and reduced arterial pressure are common results of poisonous doses of eucalyptus.

Treatment of Poisoning.—The stomach should be emptied, and the treatment should include the administration of alkalies or some preparation of iron, eliminants, strychnine, coffee, and diffusive stimulants.

Therapeutics.—The author is indebted to Prof. G. Frank Lydston, M. D., for the following communication in regard to the therapeutics of this drug. Dr. Lydston's experience with the remedy, having been very extensive, lends to his statements authoritative weight; he is therefore quoted verbatim:

"Eucalyptus is, in my experience, a most valuable remedy in *chronic inflammation of mucous membranes.* In *nasopharyngeal catarrh* it is of especial value. It may be used either in the form of spray or a thin ointment. If used as a spray, it should be combined with albolene or liquid vaseline in the proportion of 15 to 20 drops (0.92–1.23 Cc.) of the oil of eucalyptus to the ounce (30 Cc.) of menstruum. The strength may be considerably increased as tolerance is established. The most eligible preparation in the form of ointment is a combination of oil of eucalyptus with lanoline, sufficient albolene being added to liquefy the ointment. The eucalyptus may be used in this manner in a strength of 30 to 60 minims (1.84–3.7 Cc.) to the ounce (32.0 Gm.). The action of the eucalyptus is mildly stimulant and astringent and decidedly antiseptic.

"Eucalyptus has proven of value in my hands as a local application in *acute* and *chronic skin diseases.* In *simple dermatitis* a mild ointment of eucalyptus is quite efficacious. In chronic affections, such as some forms of *eczema* and *psoriasis*, a strong ointment of eucalyptus, or even the pure oil itself, may in some cases be applied with great benefit.

"Eucalyptus is also valuable in the treatment of sluggishly granulating *wounds* and *ulcers.* In *gastro-intestinal diseases* eucalyptus is of great value. It is a gastro-intestinal antiseptic of great merit, and one which should be more generally used. In certain forms of *diarrhea* due to the development of toxines in the gastro-intestinal tract the drug is a most valuable remedy. It has

the merit of marked antiseptic action without sufficient astringent effect to interfere with the normal method of elimination by the bowel. In *typhoid fever* eucalyptus is in my opinion more strongly indicated than any other drug. Inasmuch as salol has such an enviable reputation as an intestinal antiseptic, it might be well to suggest that the oil of eucalyptus may be with propriety combined with that drug. I have used the eucalyptus alone and combined with salol, and am satisfied that either way is better than the use of the salol alone.

"It has been my fortune to have a moderately extensive experience in the use of eucalyptus in *malarial affections*. Diseases of malarial origin are infrequently met with in Chicago and its immediate environs, but in the New York hospitals at the time I was serving as interne typical malarial affections were abundant. I experimented at that time quite extensively with eucalyptus, and found that the drug was not to be relied upon in distinct attacks of acute ague, but that it was of considerable value in the chronic forms and in the peculiar lassitude and depression with which patients who were not affected with typical malarial exacerbations often suffered.

"After some years' experimentation with eucalyptus I have become convinced that its most valuable property is that of a urinary antiseptic. I take the opportunity of repeating here what I have repeatedly said elsewhere, that eucalyptus is the most reliable urinary antiseptic at our command. Careful experimentation and clinical observation have shown me that in eucalyptus we have a remedy which greatly lessens the dangers of genito-urinary surgery by lessening or entirely removing the septic property of the urine, that *bête noire* of the andrologist. Boric acid and salol have in my experience been disappointing, while eucalyptus has exceeded my anticipations. My method of administration is by capsule, 10 minims (0.6 Cc.) of the oil being given four times daily, beginning several days before the operation. The only disadvantage attending the use of eucalyptus is gastric intolerance on the part of a few patients. As a rule, the remedy is taken without complaint, but occasionally disagreeable eructations or even vomiting occurs. By preceding the remedy with a large draught of milk this objection may usually be done away with. In some cases suspension of the remedy for a few hours will enable the stomach to acquire the desired toleration.

"In the administration of eucalyptus much depends upon the

ration used. Without the slightest desire to advocate unduly pecial preparation, but simply as a matter of information to rofession, I will state that in my experience the preparations n as Tyndale's are the most reliable and elegant upon the et. These preparations comprise an aqueous solution, an ient, and an oil, the latter of which is in daily use in my ice."

he foregoing quotation expresses so clearly the uses of euca- s that further details appear unnecessary. The antiseptic erties of the drug are not sufficiently realized by many physi- . Schultz claims that eucalyptus as an antiseptic is three as powerful as carbolic acid, and that as an agent to arrest iration it is perhaps fully equal to quinine.

s a stimulant expectorant eucalyptus is of great value, equal- if not being superior to, any other remedy in *bronchorrhea*, *mary gangrene*, and *fetid bronchitis*, associated or not with sis. Chronic or catarrhal conditions of the lungs and bronchi are benefited by eucalyptus, acute affections of the broncho- onary mucous membrane contraindicating its use. A solution of eucalyptus is used as an antiseptic inhalation in *diphtheria*.

dministration.—The fresh leaves may be employed as poul- Any of the preparations may be used, but for internal pur- the oil, or eucalyptol, is preferable, although a good fluid ct is an agreeable form of the medicine. The oil, or euca- l, may be given in an emulsion or in capsules, for topical use diluted with alcohol or oil or incorporated in suppositories or ients.

Sōdii Bōras—Sōdii Borātis—Sodium Borate.

U. S. P.

(BORAX.)

rigin.—Prepared by boiling together solutions of Boric Acid iodium Carbonate, the borax crystallizing out. It is also found iative state on the shores of certain lakes and as a crystalline it in the Borax Lake of California.

escription and Properties.—Colorless, transparent, mono- prisms, or a white powder, inodorous, and of a sweetish, ne taste; slightly efflorescent in warm, dry air; soluble in 16 of water and in 1 part of glycerin; insoluble in alcohol.

ose.—5–30 grains (0.32–2.0 Gm.).

Ăcidum Bŏricum—Ăcidi Bŏrici—Boric Acid. *U. S.*

(BORACIC ACID.)

Origin.—Found native in Northern Tuscany. It may be prepared by the action of Hydrochloric Acid on Borax, filtration, and recrystallization.

Description and Properties.—Transparent, colorless scales, or a somewhat pearly luster, or, when in perfect crystals, six-sided triclinic plates, slightly unctuous to the touch, odorless, of a faintly bitterish taste, permanent in the air. Soluble in 25.6 parts of water, 15 parts of alcohol, and 10 parts of glycerin. The addition of hydrochloric acid increases its solubility in water.

Dose.—5–15 grains (0.32–1.0 Gm.).

Official Preparation.

Glycerītum Boroglycerīni—Glycerīti Boroglycerīni—Glycerite of Boroglycerin (GLYCERITE OF GLYCERYL BORATE—SOLUTION OF BOROGLYCERIN).—Boric Acid, 310; Glycerin, to 1000. For external use.

Antagonists and Incompatibles.—The incompatibles of BORAX are the acids and metallic salts. Morphine and cocaine are precipitated from solution by BORAX. BORIC ACID is also incompatible with the carbonates and bicarbonates, and with the alkaline, earthy, and metallic bases.

Synergists.—The action of BORAX is enhanced by alkalies and substances promoting waste; that of BORIC ACID, by the antiseptics.

Physiological Action.—*Externally and Locally.*—BORAX is absorbent, protectant, sedative, and antiseptic. Applied to the unbroken skin, it acts upon the epidermis as a soap. By removing the stimulus to secretion and lessening irritation borax checks the secretion of the salivary glands.

BORIC ACID possesses properties similar to those of borax, although more of an antiseptic and antipruritic. It has also an exsiccant and detergent influence.

Internally.—In a general way the action of BORAX is analogous to that of the alkalies. It is refrigerant and diuretic, and by its immediate action upon the womb serves as an emmenagogue, large doses contracting the uterine muscles and acting as an ecbolic. Excessive doses of either of these drugs act as gastro-intestinal irritants.

BORIC ACID, though stronger, resembles borax in its action. Both

on and Elimination.—It is eliminated by the saliva, per-
ces, and urine, the latter being increased in quantity.
nt of nitrogen and solid matter excreted with the feces
reased, as well as the elimination of urea in the urine.
rd Action.—BORIC ACID has occasioned the following
symptoms: frequent desire to micturate; nausea, vom-
ther gastric disturbances; small, weak pulse; derange-
ne nervous system; hiccough; and various cutaneous

g.—The symptoms of poisoning are analogus to those
bove.
nt of Poisoning.—The treatment of poisoning should
matic, stimulants, morphine, etc. being employed.
eutics.—*Externally and Locally.*—Both of the above
exceedingly valuable as local remedies in the treatment
isorders of the ear, nose, and throat, such as *acute* and
al catarrh, pharyngitis, gingivitis, and *acute hoarseness.*
ient domestic remedy in *aphthæ* affecting the mouths of
ildren is a mixture of BORAX and honey.
luable aseptic application in *acute conjunctivitis* is a sat-
ution of BORIC ACID, and the dry powder serves as an
medy in otorrhea.
hea, gonorrhea, and *chronic cystitis* are greatly benefited
s, in various strengths, of either or both of these drugs.
Simpson recommends a solution of BORAX, 5–10 grains
m.) to 1 ounce (30.0 Cc.) of hot water, for the *eruption*
n the mucous membrane of the vulva in young girls.

nizing the conditions in which this potent remedy may be advantageously employed.

Internally.—BORAX is used internally more than boric acid. While in *epilepsy* inferior to the bromides, there are cases uninfluenced by the latter remedies which respond favorably to borax.

The drug has been employed in *typhoid fever*, though with little benefit. Dr. Sacaze of Montpelier claims to have greatly improved a case of *paralysis agitans* with 4- to 8-grain (0.25–0.51 Gm.) doses, given three times a day.

The author has favorably influenced the character of the urine in *chronic cystitis* by 5-grain (0.3 Gm.) doses of BORIC ACID three times a day.

These drugs have been used internally in the *summer diarrhea of children.*

Administration.—The remedies may be given in capsules or solution. The taste of borax may be disguised by coffee, syrup of orange, or aromatic elixir of liquorice, the drug not being administered with glycerin, lest an acid reaction occur.

Potăssii Permănganas—Potăssii Permanganātis—Potassium Permanganate. *U. S. P.*

Origin.—Obtained by heating together Caustic Potash, Potassium Chlorate, and Manganese Dioxide. The potassium manganate formed is converted into the permanganate by boiling it in water.

Description and Properties.—Slender, monoclinic prisms, of a dark-purple color, almost opaque by transmitted light, and of a blue, metallic luster by reflected light; odorless, with at first a sweet and afterward a disagreeable and astringent taste; permanent in the air; soluble in 16 parts of water. In contact with alcohol it is decomposed.

Potassium permanganate should be kept in glass-stoppered bottles, protected from light, and should not be brought in contact with organic or readily oxidizable substances.

Dose.—½–2 grains (0.03–0.12 Gm.), as a pill.

Antagonists and Incompatibles.—Organic matter easily deoxidizes it, causing an explosion.

Synergists.—Theoretically, the antiseptics would enhance its antiseptic action.

Physiological Action.—Potassium permanganate is employed as an antiseptic and oxidizing agent in certain diseases, both the

internal and external use of the drug having proved beneficial. The peculiar property of the remedy is its readiness to part with oxygen, and its consequent availability as an agent in the destruction of deleterious organisms. Brunton asserts that "when mixed with cobra-poison it completely destroys the deadly power of the latter, and the mixture may be injected subcutaneously without any bad effect," though he adds that as an antidote it is unserviceable, since it does not come in contact with the venom in the tissues.

In rare instances, it is asserted, potassium permanganate has occasioned a vesicular eruption not unlike eczema. It is at times decidedly caustic.

Therapeutics.—*Externally and Locally.*—In concentrated solutions or in substance it is a mild escharotic. Its readiness to part with ogygen renders it of great value as a deodorant, and in dilute solutions, 1 to 5 grains (0.06 to 0.32 Gm.) to 1 ounce (30 Cc.) of water, it is a useful application to *foul ulcers, cancer of the uterus, vagina*, etc. A solution of this drug is employed for various purposes as an antiseptic, germicide, and deodorant, in the treatment of *gonorrhea, leucorrhea, diphtheria, putrid sore throat, ozena, naso-pharyngeal catarrh, cancer of the tongue*, and *syphiltic ulcers.*

A weak solution of POTASSIUM PERMANGANATE is an efficient application in *bromidrosis*, and a 1 : 2000 or 1 : 5000 solution is recommended by Dr. Terson in *purulent ophthalmia.* Potassium permanganate should not be used as an antiseptic in the peritoneal cavity, on account of its irritating properties. It is employed extensively in surgical practice for washing the hands and utensils.

Internally.—Like iron, POTASSIUM PERMANGANATE has been employed in *anemia*, although far inferior to the former drug. Favorable reports are given regarding its value in *gastric fermentation* and *lithiasis.*

Dr. Moor of New York recently advocated its use as an antidote to *morphine-poisoning.* It seems to form a chemical substance with morphine which is circulating in the blood, rendering the latter inert. The drug has, therefore, been considered by some authorities a true *physiological* antagonist in morphine-poisoning, whether administered hypodermically or by the mouth. Other authorities claim that it is but a *chemical* antagonist for morphine, being active only when brought in actual contact with the poison.

Dr. Moor claims, however, that potassium permanganate does not possess the same antidotal power over certain other alkaloids, such as strychnine, atropine, cocaine, aconitine, etc. Antal, on the

other hand, maintains that the drug is equally serviceable in *morphine-* and *strychnine-*, as well as *muscarine-*, *poisoning*, and in that resulting from toxic doses of *colchicum* and *oxalic acid*. Dr. Koosa believes it to be also efficient in *poisoning from hydrocyanic acid*, and Dr. Hognos reports very favorably as to its antidotal power in *poisoning from phosphorus*, having treated two cases successfully with this remedy.

Recently, Dr. Fr. Lanz reports interesting statistics of Prof. von Jaksch's clinic in which phosphorus-poisoning was treated with douches of potassium permanganate, the death-rate, however —36.66 per cent.—not speaking very favorably for the antidotal power of the drug in connection with phosphorus.

Administration.—For internal use potassium permanganate should always be given in pill form, kaolin being used as an excipient, lest an explosion occur.

Potăssii Bichrōmas—Potăssii Bichromātis—Potassium Bichromate. *U. S. P.*

Origin.—Prepared by roasting in a reverberatory furnace Potassium Carbonate and Chrome-iron Ore, with the addition of Lime or Chalk to prevent fusion. The potassium bichromate formed is separated by crystallization from its solution in water acidulated with sulphuric acid.

Description and Properties.—Large orange-red, transparent triclinic prisms or four-sided tables, odorless, and having a bitter, metallic taste. Permanent in the air; soluble in 10 parts of water; insoluble in alcohol.

Dose.—$\frac{1}{100}$–1 grain (0.0006–0.06 Gm.).

Antagonists and Incompatibles.—Potassium bichromate is incompatible with soluble salts of silver, mercury, and lead, and with liquor potassæ, liquor sodæ, and ammonia water.

Synergists.—Agents promoting waste, antiseptics, and caustics.

Physiological Action.—*Externally and Locally.*—In substance potassium bichromate is an irritant caustic, and, according to Miquel, an antiseptic in the proportion of 1 to 909.

Internally.—Its action is nearly identical with that of potassium chlorate, with the additional properties of an expectorant, emetic, and mild alterative.

Poisoning and *treatment of poisoning* do not differ essentially from those of potassium chlorate.

Therapeutics.—*Externally and Locally.*—Potassium bichromate

is used as a caustic for *warts, corns, chancres, chancroids, mucous patches*, etc., and is also of considerable value as a gargle in *pharyngitis*.

Internally.—Frazer has recently recommended this drug in the treatment of *dyspepsia* and *gastric ulcer*, claiming that the pain, nausea, vomiting, and tenderness may be readily allayed by doses of $\frac{1}{12}$ to $\frac{1}{6}$ grain (0.005–0.01 Gm.), taken upon an empty stomach three times a day. In *acute gastric ulcer* he has perceived no benefit so far as its effect upon the hemorrhage is concerned, the most desirable action of the drug in the latter condition being derived from its antiseptic and analgesic influence.

The author desires to recommend favorably potassium bichromate, in doses of $\frac{1}{100}$ grain (0.0006 Gm.) every hour or two, in *aphonia* and *hoarseness* due to excessive action of the vocal cords or resulting from an acute cold. He has found this method of treatment peculiarly and speedily efficacious.

Potăssii Chlōras—Potăssii Chlorātis—Potassium Chlorate. *U. S. P.*

Origin.—Prepared by passing Chlorine into a mixture of Potassium Carbonate and Slaked Lime. By subsequent boiling in water the chlorate separates by crystallization.

Description and Properties.—Colorless, lustrous, monoclinic prisms or plates, or a white powder, odorless, and having a cooling, saline taste; permanent in the air; soluble in 16.7 parts of water; insoluble in absolute alcohol. Potassium chlorate should be kept in glass-stoppered bottles. *Great caution should be observed* in handling the salt, since dangerous explosions are liable to occur when it is mixed with organic matters—cork, tannic acid, sugar, etc.—or with sulphur, antimony sulphide, phosphorus, or other easily oxidizable substance, or upon being either heated directly or subjected to trituration or concussion.

Dose.—3–20 grains (0.2–1.3 Gm.).

Official Preparation.

Trochĭsci Potăssii Chlorātis — Trochĭscos (acc.) **Potăssii Chlorātis — Troches of Potassium Chlorate.**—Each troche contains 5 grains (0.32 Gm). *Dose*, 1 to 4 troches.

Antagonists and Incompatibles.—In addition to those substances mentioned above with which potassium chlorate forms

explosive compounds, mixture with glycerin and the hypophosphites is liable to produce similar dangerous results.

Synergists.—Agents promoting waste increase the activity of the drug.

Physiological Action.—*Externally and Locally.*—It is slightly detergent and stimulant, antiseptic and astringent, being irritant when applied in concentrated solution to ulcerated surfaces.

Internally.—Digestive System.—Medicinal doses have no effect; poisonous doses excite violent gastro-intestinal irritation, nausea, bloody vomiting, diarrhea, and jaundice.

Circulatory System.—Small doses of potassium chlorate tend to depress and subsequently raise arterial tension, accelerating the pulse; large doses lower arterial pressure alarmingly; toxic doses convert the hemoglobin of the blood into methemoglobin, the disorganized fluid appearing in the urine. Post-mortem lesions are—enlargement of the liver, spleen, and kidneys, with evidences of marked inflammation over the whole intestinal tract.

Nervous System.—Medicinal doses are inert. Toxic doses may produce delirium and death, preceded by coma or convulsions.

Respiratory System.—Large doses act as a depressant to the respiratory apparatus.

Absorption and Elimination.—The drug is absorbed with considerable rapidity, being chiefly eliminated by the salivary glands unchanged. The drug does not increase the urinary flow, large doses, on the contrary, tending to suppress it.

Temperature.—Unaffected by medicinal doses, but lowered by toxic amounts.

Untoward Action.—Small doses of potassium chlorate seldom produce untoward symptoms, although in rare instances eruptions of an erythematous, papular, or vesicular nature have followed the use of the drug. Digestive disturbances occasionally ensue, as well as pain in the region of the kidneys and albuminuria.

Poisoning.—In the few recorded cases of poisoning there were observed a continuous sensation of choking, excessive thirst, persistent vomiting, pain in the abdomen and renal tract, and violent hiccough. Accompanying symptoms were—a small and rapid pulse and faintness, while the urine was albuminous and diminished in quantity; epistaxis was present; the eyes and lips were cyanotic, and the skin slightly jaundiced and markedly anemic; the liver and spleen were slightly enlarged; and there were alternating sensations of cold and heat, with drowsiness ending in coma and death.

Treatment of Poisoning.—The stomach should be emptied as quickly as possible and demulcents administered. The patient should be treated symptomatically, and it may be advisable to practice venesection, followed by transfusion of blood, as suggested by Landerer.

Therapeutics.—*Externally and Locally.*—A solution of this drug has been applied with some success in *foul ulcers* and *moist eczema.* Like the potassium permanganate, it has been employed in various *diseases of the nose and throat,* and is especially serviceable in *ptyalism* and *aphthous ulceration.* As a remedy for *syphilitic mucous patches* and *herpes of the buccal cavity* it is of considerable value. It is more efficient in *acute* than in *chronic pharyngitis.*

It possesses marked cicatrizing power, advantage of which property has been taken in the treatment of *phagedenic sores,* the powdered drug being used for this purpose. It is thought that enemas of potassium chlorate solution favor the healing of *rectal ulcers.*

Internally.—As a remedial agent this drug has not met with the success prophesied by many physicians. Dr. Coghill of England is one of its most enthusiastic champions, the drug having proved in his hands highly efficient in improving the quality of the blood in such cases as *simple anemia, chlorosis,* etc., as well as in "pulmonary insufficiency" and "deficient oxygenation of the blood." Other physicians have recommended it as a valuable galactagogue, tonic, and alterative, and as beneficial in certain *chronic diseases of the skin, scrofula,* etc. It has found some advocates as a *genito-urinary* antiseptic and as a remedy in *typhoid fever.*

Yet, notwithstanding the extravagant, though isolated, reports concerning the great value of the drug, its utility has not been universally recognized; indeed, so good an authority as Marchand declares that "chlorate of potassium should be entirely rejected in practice, and particularly in the treatment of children."

Administration.—It may be given in the form of troches, powder, tablets, or a solution, an agreeable means of administration being in aërated water. Owing to its tendency to decomposition when combined with other substances, the drug should be prescribed alone.

Āqua Hydrogēnii Diŏxidi—Āquæ Hydrogēnii Diŏxidi—Solution of Hydrogen Dioxide. *U. S. P.*

Origin.—A slightly acid, aqueous solution of hydrogen dioxide, containing, when freshly prepared, about 3 per cent. by weight

of the pure dioxide, corresponding to about 10 volumes of available oxygen.

Description and Properties.—A colorless liquid, without odor, slightly acidulous to the taste, and producing a peculiar sensation and a soapy froth in the mouth; liable to deteriorate with age or by exposure to heat or protracted agitation.

Dose.—1–4 fluidrachms (3.7–15.0 Cc.), well diluted with water.

Physiological Action.—*Externally and Locally.*—The principal action of this preparation seems to be its property of imparting oxygen to all oxidizable substances, it being one of the most powerful oxidizing agents in Materia Medica, and therefore an exceedingly active non-toxic antiseptic.

When applied to a suppurating surface, or when mixed with mucus, cerumen, or blood, active effervescence is produced. Hydrogen dioxide is a useful detergent and bleaching agent, being employed largely for the purpose of bleaching hair and delicate fabrics.

Internally.—It is asserted that hydrogen dioxide yields oxygen to the blood, slightly stimulates the nervous system, and acts as a diuretic.

Therapeutics.—*Externally and Locally.*—Hydrogen dioxide is extensively employed to cleanse diseased surfaces, such as *ulcers, buboes, fistulous tracts*, etc. It has been highly recommended as an antiseptic in abdominal surgery. As an antiseptic wash in *empyema, cystitis, joint-cavities, venereal sores, puerperal septic endometritis*, etc. hydrogen dioxide is an exceedingly valuable agent.

Hydrogen dioxide appears to be an efficient injection in *gonorrhea*, and is much used as an antiseptic in many diseases of the *eye, ear, nose*, and *throat.* It has been highly recommended as a solvent for *diphtheritic membrane*, although when frequently applied to the throat it causes an unpleasant sensation of dryness, and it seems to prevent the exfoliation of the membrane when the patient is treated with antitoxine.

Hydrogen dioxide serves a useful purpose in disinfecting drinking-water when suspected of pollution, 1 part sufficing for 1000 parts of water, in which amount the taste or other potable qualities of the water are in no way impaired.

Internally.—While hydrogen dioxide has been recommended in *epilepsy, diabetes, angina pectoris, pneumonia, asthma*, and *dyspnea* due to deficient circulation of blood through the heart and lungs, the results following the internal administration in these diseases

have not warranted classing the drug among important internal medicines.

Administration.—For external and local use the drug may be gargled, sprayed, or applied with a syringe or a swab, either in full strength or diluted with water. Whether for external or internal use, the solution should be freshly prepared; when given internally it should be taken from a porcelain or china, not a metal, cup or spoon.

Ăcidum Sulphurōsum—Ăcidi Sulphurōsi—Sulphurous Acid. *U. S. P.*

Origin.—A liquid composed of not less than 6.4 per cent. by weight of Sulphurous Acid Gas (Sulphur Dioxide) and not more than 93.6 per cent. of Water.

Description and Properties.—A colorless liquid, of the characteristic odor of burning sulphur, and of a very acrid, sulphurous taste. It should be kept in dark-colored, glass-stoppered bottles, in a cool place, and protected from light.

Dose.—½–2 fluidrachms (1.8–7.39 Cc.).

Physiological Action.—*Externally and Locally.*—Sulphurous acid is a powerful deoxidizing agent, the fumes of burning sulphur having been employed centuries ago to disinfect temples, dwellings, etc. It easily abstracts oxygen from organic bodies, the acid, in short, being a powerful disinfectant, antiseptic, deodorant, and parasiticide.

Internally.—The disinfecting properties of sulphurous acid are less apparent when the drug is ingested than when it is used externally.

Therapeutics.—*Externally and Locally.*—As an antiseptic, disinfectant, and deodorant sulphurous acid may be employed in the treatment of various *parasitic skin diseases*, and a solution of sulphurous acid affords an efficient application to the throat in *pharyngitis*, particularly the gangrenous form, *diphtheria*, etc.

According to Dujardin-Beaumetz, Sollaud, and Balbaud, non-febrile *pulmonary phthisis* is often favorably influenced by the daily inhalation for a short time of sulphurous-acid vapor. This disagreeable, not to say dangerous, method of treatment has neither been generally adopted nor proved to be of established efficacy.

The acid is a useful antiseptic to apply to recent *wounds*, and may be employed to disinfect the *dejections* of the sick, the fumes

from sulphur burned in moist air also being serviceable to disinfect rooms and bedding tainted with infectious disease.

Internally.—Sulphurous acid is seldom used internally, though, owing to its powerful antifermentative properties, it has been employed in so-called *fermentative dyspepsia*, *intestinal fermentation*, and *urticaria*. While it checks fermentation in the laboratory, its effect is less certain in the body; nor can the internal administration of the drug be regarded as satisfactory.

Administration.—Sulphurous acid should be given well diluted with water.

Sōdii Sŭlphis—Sōdii Sulphītis—Sodium Sulphite. *U. S. P.*

Origin.—Prepared by saturating a solution of Sodium Carbonate or Caustic Soda with Sulphur-dioxide Gas.

Description and Properties.—Colorless, transparent, monoclinic prisms; odorless, and having a cooling, saline, sulphurous taste. In the air the salt effloresces and is slowly oxidized to sulphate. Soluble in 4 parts of water; sparingly soluble in alcohol. It should be kept in well-stoppered bottles, in a cool place.

Dose.—5–60 grains (0.3–4.0 Gm.).

Sōdii Bisŭlphis—Sōdii Bisulphītis—Sodium Bisulphite. *U. S. P.*

Origin.—Prepared from Sodium Carbonate or Bicarbonate and Sulphur Dioxide.

Description and Properties.—Opaque, prismatic crystals, or a granular powder, exhaling an odor of sulphur dioxide, and having a disagreeable, sulphurous taste. Exposed to the air, the salt loses sulphur dioxide and is gradually oxidized to sulphate. Soluble in 4 parts of water and in 72 parts of alcohol. The drug should be kept in a cool place, in small, well-stoppered bottles filled as full as possible.

Dose.—5–30 grains (0.3–2.0 Gm.).

Sōdii Hyposŭlphis—Sōdii Hyposulphītis—Sodium Hyposulphite. *U. S. P.*

Origin.—Prepared by passing Sulphurous Anhydride into a solution of Sodium Carbonate with Salts.

Description and Properties.—Colorless, transparent, monoclinic prisms; odorless, and of a cooling, afterward bitter, taste.

in 0.65 part of water; insoluble in alcohol. It should be well-stoppered bottles.

.—5–20 grains (0.3–1.3 Gm.).

iological Action and Therapeutics of Sodium Sulphite, te, and Hyposulphite.—These substances are feeble ger- nd antiseptics, checking putrefaction and other forms of tion. It is supposed that they are decomposed in the , liberating sulphurous anhydride; on which assumption e been given to arrest *gastric fermentation* and as reme- *typhoid* and *yellow fevers, diphtheria, erysipelas*, etc. The sis, however, upon which they have been thus hopefully d has not been confirmed by clinical experience.

e drugs have nevertheless proved efficacious in the treat- *scabies, sycosis, impetigo, favus*, etc. . Atomized solutions m hyposulphite inhaled are beneficial in *gangrene of the tid bronchitis*, etc.

inistration.—The foregoing preparations of sulphur may in solution or in this form applied topically. The sodium hite may also be applied in the form of an ointment.

ia Chlōri—Āquæ Chlōri—Chlorine Water.

U. S. P.

n.—An aqueous solution of Chlorine, containing at least cent. of the gas.

ription and Properties.—A clear, greenish-yellow liquid, he suffocating odor and disagreeable taste of chlorine, and no residue on evaporation. Chlorine water, even when m light and air, is apt to deteriorate; when it is required trength, it should be freshly prepared.

.—1–4 fluidrachms (3.7–15.0 Cc.).

gonists and Incompatibles.—The salts of lead and silver npatible.

rgists. — The antiseptics are theoretically synergistic, practically the drug is almost always used alone.

iological Action. — *Externally and Locally.* — Chlorine a powerful antiseptic, germicide, and deodorant. When to the skin it acts as a rubefacient and vesicant, while the quite irritating to the respiratory passages.

nally.—Chlorine water is more or less irritating to the membrane of the stomach, and possesses an astringent

Therapeutics.—*Externally and Locally.*—Chlorine water is still occasionally used as an antiseptic and deodorant in *gangrenous or sloughing wounds* and for disinfecting *foul discharges*, etc. It has proved beneficial as a local application in *aphthous stomatitis, diphtheria*, and *parasitic skin diseases.*

Internally.—Chlorine water is so seldom employed internally that its use in this respect scarcely requires comment.

Administration.—When given internally the drug should be well diluted. Should poisoning ensue from the ingestion of excessive amounts, albumen is the best antidote; for the irritation occasioned by the inhalation of chlorine gas steam-inhalations are indicated.

Călx Chlorāta—Călcis Chlorātæ—Chlorinated Lime. *U. S. P.*

("Chloride of Lime.")

Origin.—A compound resulting from the action of Chlorine upon Calcium Hydrate, and containing not less than 35 per cent. of available Chlorine.

Description and Properties.—A white or grayish-white, granular powder, exhaling the odor of hypochlorous acid; of a repulsive saline taste, and becoming moist and gradually decomposing on exposure to air. It is but partially soluble in water or alcohol. The drug should be kept in well-closed vessels, in a cool and dry place. Used externally.

Physiological Action and Therapeutics.—Chlorinated lime is a powerful disinfectant, yielding, when exposed to air, hypochlorous acid, which is resolved into chlorine and chloric acid, the last in turn yielding chlorine.

The effects of the drug are therefore analogous to those of chlorine, yet almost the only use which chlorinated lime serves is in disinfecting cesspools and utensils employed for the dejections of invalids.

Līquor Sōdæ Chlorātæ—Liquōris Sōdæ Chlorātæ—Solution of Chlorinated Soda. *U. S. P.*

(Labarraque's Solution.)

Origin.—An aqueous solution of several chlorine compounds of Sodium, containing at least 2.6 per cent. by weight of available chlorine.

r *fetid ulcers*, *gangrenous sores*, and *ozena*, and as a disin-
ash in *diseases of the uterus*, *vagina*, and *auditory canal*.
inistration.—There are no special directions to be ob-
ı the application of this solution.

AROMATICS.

following-named drugs, classed by some authors as aro-
are not only active antiseptics and antispasmodics, but
properties very similar to those of the more typical anti-
antipyretics, and anesthetics. These antiseptic properties
atic drugs are well known to modern science, and, what is
e interest and significance, were perfectly familiar to the
who could not possibly divine the scientific value of the
miliarized only by the crudest empiricism. In the custom
gyptians of embalming the dead we have a remarkable
of their divination of antisepsis in the perfumes and spices
their dead were buried; and in the Christian Gospel we
Nicodemus that he "brought a mixture of myrrh and
nd that they "took the body of Jesus, and wound it in
ths with the spices, as the manner of the Jews is to bury"
K. 39, 40).
, however, from the remarkable testimony of the fore-
amples, these peculiar properties of aromatic herbs appear
een established in all succeeding ages. Especially among
ks were the *medicinal* virtues of certain aromas recognized.

common faith in their healing power, though from the derivation of the word—*per*, through, and *fumum*, smoke—the offering of incense, by burning aromatic woods, spices, and gums, seems to have been the original use suggested by them. This conception of the sacred and purifying influence of aromas is seen to-day in the censer of the ritualistic churches, as it may be traced from earliest recorded times through the centuries that intervene.

The more secular regard for aromatic herbs, however, rests rather upon a rational, though unscientific, observation of facts than upon hierarchical assumption. It is recorded, for instance, that while cholera raged in Paris and London the gentle office in which they were engaged secured to the perfumers immunity from the plague, and that when the Dutch on the island of Ternate destroyed the clove tree the colony suffered from epidemics and disorders unknown before.

The property of absorbing malaria generally ascribed to the leaves of *Eucalyptus globulus*, but probably due to the absorption of moisture by the roots and consequent drying of the soil, is a further illustration of the medicinal uses of aromatic plants, this tree being considered a potent febrifuge. Witness also the beneficial results of planting this tree in the Roman Campagna.

Even the refined taste and delicacy of sense which have perpetuated the "perfumes of Araby" to "sweeten," not the murderous hand of a Lady Macbeth, but milady's dainty finger-tips, have their *rationale* in a basis of sanitary law. A writer on this subject observes that "the toilet vinegars had their origin in the presumption of keeping those who carried them from the effects of infectious disease, doubtless springing out of the story of the four thieves' vinegar—reputed freebooters supposed to have plundered the sick and dying, protected by the spell of an enchanted prophylactic composed of rosemary, mint, lavender, calamus, cinnamon, cloves, nutmeg, etc. macerated in vinegar."

Yet the vinaigrette of a lady's boudoir of to-day has its analogue in the beautiful scent-bottles unearthed among the ruins of Pompeii; for the cultivated tastes which still prompt the utility, as well as beauty, of flowers are fortified by the tradition of loyal centuries, and are, after all, but a tacit tribute to the truth not inaptly stated that "poison and malaria enter the system by neglecting the warning given it by the nose, that outpost of the animal citadel."

Aromatics owe their virtues chiefly to the volatile oils they contain, which usually possess the characteristic odor and taste of the

ım which they are derived. Locally, they are stimulant nt. Internally, they stimulate, when taken in moderate , the digestive organs in the same manner as vegetable d increase the activity of the circulation reflexly by stim- ıe sensory ends of the vagus distributed to the mucous ɜ of the stomach. The impression is conveyed to the the medulla, and from there transmitted to the accelerator the heart. Very large doses depress the heart's action, it in diastole. The poisonous action of aromatics is simi- ıt of irritant narcotic poisons. Many of them are quite local anesthetics. They first stimulate and then depress ıst the nervous system. In diseased conditions they are ncrease peristalsis, to impart tone to the stomach, and antiseptics; to arrest gastric and intestinal fermentation; pain wherever they are applied; and, by increasing the ı in the brain and improving the condition of the gastro- tract, to relieve many of the phenomena of hysteria. contraindication for the internal use of these drugs is in ion of the stomach and bowels.

ılatile oils and the various preparations of the aromatics ɜ given diluted in some proper vehicle.

Anīsum—Anīsi—Anise. *U. S. P.*

.—The fruit of *Pimpinella Anisum* L., a plant indigenous n Asia and Egypt, and extensively cultivated in Europe.

ption and Properties.—About $\frac{1}{8}$–$\frac{1}{4}$ inch (3–6 Mm.) long, ıpressed laterally, grayish, finely pubescent, consisting of arps, each with a flat face, and five light-brownish filiform l about fifteen thin oil-tubes, perceptible in transverse sec- ıe aid of the microscope. Anise has an agreeable, aro- r, and a sweet, spicy taste. It contains from $1\frac{1}{2}$ to 3 per volatile oil. It resembles the fruit of the Conium, differ- it usually in being longer and more ovate, and having dor and taste. The fruit of the Conium has, moreover, ʒle smooth mericarp without oil-tubes.

–8–30 grains (0.5–2.0 Gm.).

n Anīsi—Ōlei Anīsi—Oil of Anise. *U. S. P.*

.—A volatile oil distilled from Anise.

ption and Properties.—A colorless or pale-yellow, thin gly refractive liquid, having the characteristic odor of

anise, and a sweetish, mildly aromatic taste; neutral in reaction. It contains a substance known as *anethol.*

Oil of anise should be kept in well-stoppered bottles, protected from light, and if it has separated into a liquid and a solid portion, it should be completely liquefied by warming before being dispensed.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Āqua Anīsi—Āquæ Anīsi—Anise Water.—*Dose,* ½–1 fluidounce (8.0–30 Cc.).

Spĭritus Anīsi—Spĭritus Anīsi—Spirit of Anise.—*Dose,* 1–2 fluidrachms (4.0–8.0 Cc.).

Oil of anise is contained in the following preparations:

Spĭritus Aurăntii Compŏsitus; Sўrupus Sarsaparīllæ Compŏsitus; Tinctūra Ōpii Camphorāta; Trochĭsci Glycyrrhīzæ et Ōpii.

Physiological Action.—Anise is slightly antiseptic, stimulant, and carminative; Oil of Anise is irritant if applied in full strength to mucous membranes, stimulating both the digestive and circulatory apparatus, improving the appetite, and slightly strengthening and accelerating the heart's action. In very large doses it possesses mildly narcotic properties. It is excreted in the urine, sweat, and by the bronchial mucous membrane, the secretion from which it liquefies.

Therapeutics.—Anise is employed to relieve flatulence in children, as a sedative expectorant, and as a vehicle to flavor medicines.

Cinnamōmum—Cinnamōmi—Cinnamon. *U.S.P.*

Origin.—There are three official varieties of cinnamon: 1, the inner bark of the shoots of *Cinnamomum Zeylanicum* Breyne, a tree about 30 feet high (9 M.), found in the forests of Ceylon (Ceylon Cinnamon); 2, the bark of the shoots of one or more undetermined species of *Cinnamomum* grown in China (Chinese Cinnamon, Cassia Cinnamon); 3, the bark of an undetermined species of *Cinnamomum* known as *Cinnamomum Saigonicum* (Saigon Cinnamon, Saigon Cassia), from Saigon, the capital of French Cochin-China, where it is collected and exported.

Description and Properties.—Most of the article brought to the United States is the Cassia cinnamon. The varieties differ some-

ppearance, and are found in the shops as quills of varying about $\frac{1}{25}$ inch (1 Mm.) or more in thickness, yellowish-1 color, externally rough (Cassia), of fragrant odor, a omatic taste, but less delicate than that of Ceylon cinna-ich appears in large, closely-rolled quills, composed of more layers of bark of the thickness of paper; pale, 1-brown, the outer surface smooth, marked with wavy ast-bundles; of a very sweet, fragrant odor, and a warm, , delicate taste. The Saigon cinnamon is found in the large quills or broken pieces, $\frac{1}{12}$ to $\frac{1}{8}$ inch (2 to 3 Mm.) ie outer surface gray or light grayish-brown, with whitish more or less rough and warty, transversely ridged and nally wrinkled; the inner surface cinnamon or dark brown, and slightly striate, with short and granular fracture. It grant odor, and a sweet, warmly aromatic, and somewhat it taste.

ituents.—All the varieties contain *volatile oil*, tannin, , sugar, starch, a coloring principle, and a peculiar acid. fficial Oil of Cinnamon is distilled from Cassia Cinnamon. .—5–30 grains (0.3–2.0 Gm.).

Official Preparations (*Cassia Cinnamon*).

ra Cardamōmi Compŏsita—Tinctūræ Cardamōmi Compŏsitæ—d Tincture of Cardamom.—Cardamom, 20; Cassia Cinnamon, 20; Car-Cochineal, 5; Glycerin, 50; Diluted Alcohol, q. s. ad 1000 parts. *Dose*, hms (4.0–8.0 Cc.).

ra Cătechu Compŏsita—Tinctūræ Cătechu Compŏsitæ—Compound of Catechu.—Catechu, 100; Cassia Cinnamon, 50; Diluted Alcohol, q. s. rts. *Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

ra Lavăndulæ Compŏsita—Tinctūræ Lavăndulæ Compŏsitæ—Comncture of Lavender.—*Dose*, ½–1 fluidrachm (2.0–4.0 Cc.). (Formula r *Lavender*.)

Official Preparations (*Ceylon Cinnamon*).

ra Cinnamōmi (10 per cent.)—**Tinctūræ Cinnamōmi—Tincture of .**—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Aromăticus—Pŭlveris Aromătici—Aromatic Powder.—*Dose*, 10–30 -2 Gm.). (Formula given under *Cardamomum*.)

um Cinnamōmi—Ōlei Cinnamōmi—Oil of Cinnamon. *U. S. P.*

n.—A volatile oil distilled from Cassia Cinnamon.

ription and Properties.—A yellowish or brownish liquid,

becoming darker and thicker with age and exposure to the air, having the characteristic odor of cinnamon, and a sweetish, spicy, burning taste. Specific gravity, 1.055 to 1.065. Soluble in an equal volume of alcohol, the solution being slightly acid to litmus-paper; also soluble in an equal volume of glacial acetic acid. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Constituents.—Oil of cinnamon contains variable quantities of hydrocarbons, but consists chiefly of *cinnamic aldehyde*, and when old or exposed to the air for a considerable time cinnamic acid and resin are formed. *Cinnamic acid* crystallizes in shining, colorless, odorless prisms, freely soluble in alcohol, ether, and boiling water. Chlorinated lime and hot dilute nitric acid oxidize it into oil of bitter almond and benzoic acid.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Āqua Cinnamōmi (0.2 per cent.)—**Āquæ Cinnamōmi**—**Cinnamon Water.**—*Dose*, ½–1 fluidounce (15–30 Cc.).

Spĭritus Cinnamōmi (10 per cent.)—**Spĭritus Cinnamōmi**—**Spirit of Cinnamon.**—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Physiological Action.—Cinnamon is an agreeable aromatic stimulant, carminative, stomachic, astringent, hemostatic, and antiseptic. The oil possesses germicidal properties.

Therapeutics.—The same as for other aromatics. It is much used to impart an agreeable flavor to medicinal compounds and as an adjuvant to other members of this group. Preparations of cinnamon are supposed to stimulate the uterus and check *uterine hemorrhage*, and are often employed alone or in combinations with more powerful medicines for this purpose.

Coriăndrum—Coriăndri—Coriander. *U. S. P.*

Origin.—The fruit of *Coriandrum sativum* L., an annual herb about 2 feet (60.0 Cm.) high, indigenous in China and on the north-eastern shore of the Mediterranean. Cultivated in Asia, Europe, and America.

Description and Properties.—Globular, about ⅛ inch (3 Mm.) in diameter, slightly pointed at the apex and crowned with the calyx-teeth at the base. The two concave mericarps cohere, enclosing a lenticular cavity, each furnished on the face with two oil-tubes; odor and taste agreeably fragrant and aromatic.

Constituents.—Coriander contains nearly ½ of 1 per cent. of volatile oil, 13 per cent. of fatty matter, mucilage, and traces of tannin.

Dose.—8–30 grains (0.5–2.0 Gm.).

Ōleum Coriăndri—Ōlei Coriăndri—Oil of Coriander. *U. S. P.*

Origin.—A volatile oil distilled from Coriander.

Description and Properties.—A colorless or slightly yellowish liquid, having the characteristic aromatic odor of coriander, and a warm, spicy taste. It is one of the most stable of the volatile oils.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Confĕctio Sĕnnæ (5 per cent.)—**Confectiōnis Sĕnnæ—Confection of Senna.**—*Dose*, 1–2 drachms (4.0–8.0 Gm.). (Formula given under *Senna.*)

Spĭritus Junĭperi Compŏsitus—Spĭritus Junĭperi Compŏsiti—Compound Spirit of Juniper.—*Dose*, 2–4 fluidrachms (8.0–15.0 Cc.). (Formula given under *Carum.*)

Physiological Action and Therapeutics.—The same as those of the other volatile oils. Frequently used as a corrective to purgative medicines.

Fœnĭculum—Fœnĭculi—Fennel. *U. S. P.*

Origin.—The fruit of *Fœniculum capillaceum* Gilibert, an herbaceous annual or perennial indigenous in Southern Europe and cultivated in Germany, France, and the United States.

Description and Properties.—Oblong, nearly cylindrical, slightly curved, from ⅙ to ½ inch (4–12 Mm.) long, brownish or greenish-brown, readily separable into the two prominent mericarps, each with five light-brown, obtuse ribs, with four oil-tubes on the back and two or four upon the flat face; odor and taste aromatic, anise-like.

Constituents.—Fennel contains from 2 to 4 per cent. of *volatile oil*, which is almost identical chemically with that of anise, 12.5 per cent. of fixed oil, and sugar.

Dose.—8–30 grains (0.5–2.0 Gm.).

Official Preparation.

Infūsum Sĕnnæ Compŏsitum—Infūsi Sĕnnæ Compŏsiti—Compound Infusion of Senna.—*Dose*, 1–2 fluidounces (30.0–60.0 Cc.). (Formula given under *Senna.*)

Ōleum Fœnĭculi—Ōlei Fœnĭculi—Oil of Fennel. *U. S. P.*

Origin.—A volatile oil distilled from Fennel.

Description and Properties.—A colorless or pale-yellowish liquid, having the characteristic aromatic odor of fennel, and a sweetish, mild, and spicy taste. Soluble in an equal volume of alcohol. It should be kept in well-stoppered bottles, in a cool place, and if it has partly or wholly solidified, it should be completely liquefied by warming before being dispensed.

Constituents.—It has the same constituents as the oil of anise.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Āqua Fœnĭculi (2 per cent.)—**Āquæ Fœnĭculi—Fennel Water.**—*Dose*, ½–1 fluidounce (8.0–30.0 Cc.).

Pŭlvis Glycyrrhīzæ Compŏsitus—Pŭlveris Glycyrrhīzæ Compŏsiti—Compound Liquorice Powder.—*Dose*, ½–2 drachms (2.0–8.0 Gm.). (Formula given under *Senna*.)

Spĭritus Junĭperi Compŏsitus (0.5 per cent.)—**Spĭritus Junĭperi Compŏsiti—Compound Spirit of Juniper.**—*Dose*, 2–4 fluidrachms (8.0–15.0 Cc.). (Formula given under *Carum*.)

Physiological Action and **Therapeutics** are the same as those of anise.

Căpsicum—Căpsici—Căpsicum. *U. S. P.*

(Cayenne Pepper.)

Origin.—The fruit of *Capsicum fastigiatum* Blume, a small crooked-branched shrub, 1 to 2 feet (30–60 Cm.) high, indigenous in tropical America and Asia, and cultivated in gardens. The fruit is an oblong-conical pod from ⅛ to ¾ inch (8–19 Mm.) long, of a crimson or yellow color. It encloses two or three cells containing flat, reniform, yellowish seeds, attached to a thick, central placenta. These pods when dried and ground form capsicum, which has a peculiar odor and an intensely hot, aromatic taste. This ground product is of a bright-red color, fading upon long exposure to the light. Capsicum of the market usually consists of several species ground together, and is often adulterated with sawdust and sometimes with red lead.

Constituents.—Capsicum contains *capsaicin*, an acrid principle found in the greatest amount in the African product; also a volatile alkaloid, fixed and volatile oil, and fat acids.

Dose.—3–5 grains (0.2–0.3 Gm.).

Official Preparations.

Extractum Capsici Fluidum—Extracti Capsici Fluidi—Fluid Extract of Capsicum.—*Dose*, ½–to 2 minims (0.03–0.12 Cc.).

Emplastrum Capsici—Emplastrum (acc.) **Capsici—Capsicum Plaster.** For external use.

Oleoresina Capsici—Oleoresinæ Capsici—Oleoresin of Capsicum.—*Dose*, ¼–1 minim (0.015–0.06 Cc.).

Tinctura Capsici—Tincturæ Capsici—Tincture of Capsicum.—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Physiological Action.—*Externally and Locally.*—Capsicum is an irritant and rubefacient, producing vesication if kept in contact with the skin for a long time. It so irritates the mucous membrane of the mouth and nose as to induce sneezing.

Internally.—Digestive System.—Capsicum is a powerful gastro-intestinal stimulant, increasing the flow from the salivary, gastric, and intestinal glands. It increases the blood-supply to, and stimulates the walls of, the stomach, occasioning a sense of heat. It is a powerful carminative. Large doses produce great irritation in the stomach and bowels.

Circulatory System.—It is a powerful stimulant to the heart, greatly increasing the strength and rapidity of its action.

Absorption and Elimination.—It is chiefly eliminated by the kidneys, increasing the flow of urine. Large doses may produce vesical tenesmus, and aphrodisiac effects have sometimes been produced.

Therapeutics.—*Externally and Locally.*—Owing to its counter-irritant action, capsicum is employed to relieve *lumbago, torticollis, neuralgia, rheumatic pains*, and *acute inflammations of the skin* or *mucous membrane.* An infusion or the diluted tincture is an excellent gargle in *relaxed uvula, pharyngitis*, and the *angina of scarlet fever.*

The tinctures of capsicum and cantharides have been used to stimulate the scalp in the various forms of *alopecia.* The tincture is frequently used as a domestic remedy for the benefit of *chilblains* and *toothache.*

Internally.—Capsicum is a most valuable stomachic in an atonic condition of the digestive organs, and a very efficient remedy in the *irritable* and *catarrhal conditions of the stomach* due to the excessive use of alcohol.

The tincture of capsicum or the powdered drug, added to hot water or to hot water and whiskey, makes a valuable and rapid cardiac and vascular stimulant.

Contraindications.—Capsicum and its preparations should not be given in acute inflammatory affections of the gastro-intestinal and genito-urinary tracts.

Administration.—The oleoresin and the powder should be given in pills or capsules. The fluid extract and the tincture should be administered well diluted with water.

Pīper—Pīperis—Pepper. *U. S. P.*

(Black Pepper.)

Origin.—The unripe fruit of *Piper nigrum* L., a knotted, pointed-branched, aromatic, climbing shrub, indigenous in India, and cultivated in many of the East Indian and Philippine and some of the West Indian islands.

Constituents.—Its important constituents are a *volatile oil* (1 to 2 per cent.); a neutral principle, *piperin* (6 to 8 per cent.); and a pungent, soft, dark-green *resin*, to which the acrid taste and medicinal properties of pepper are due.

Dose.—5–20 grains (0.3–1.2 Gm.)

Official Preparations.

Oleoresīna Pīperis—Oleoresīnæ Pīperis—Oleoresin of Pepper.—*Dose*, ¼ grain (0.015–0.06 Gm.).

Piperīnum—Piperīni—Piperin.—*Origin.*—A neutral principle obtained from Pepper, as well as from other plants of the natural order *Piperaceæ*.

Description and Properties.—Colorless, or pale-yellowish, shining, prismatic crystals, odorless, and almost tasteless when first taken into the mouth, but after a while producing a sharp, biting sensation. Permanent in the air; almost insoluble in water, but soluble in 30 parts of alcohol and in 1 part of boiling alcohol. It is isomeric with morphine, and can be decomposed into *piperic acid* and a liquid alkaloid, *piperidine*.

Dose.—1–10 grains (0.03–0.6 Gm.).

Derivative Compound.

Piperonal—Heliotropin.—Obtained from Piperic Acid by oxidation. It occurs in small white crystals, soluble in about 600 parts of cold water, and very readily soluble in alcohol and ether. The *dose* is 10–15 grains (0.6–1.0 Gm.). It has been used as an antiseptic and antipyretic.

Physiological Action and **Therapeutics** of pepper and its preparations are almost identical with those of capsicum.

Pepper, particularly piperin, possesses antiperiodic and antiseptic properties to a greater extent than capsicum.

Myrīstica—Myrīsticæ—Nutmeg. *U. S. P.* Mācis—Mācidis—Mace. *U. S. P.*

Origin.—The seed (Myristica) and the membrane, "arillode,"

investing the kernel (Mace) of *Myristica fragrans* Houttuyn, a tree about 30 feet (9 M.) high, found in the Molucca Islands and cultivated in the East Indies.

Ōleum Myrĭsticæ—Ōlei Myrĭsticæ—Oil of Nutmeg. *U. S. P.*

Origin.—A volatile oil distilled from Nutmeg.

Description and Properties.—A thin, colorless or pale-yellowish liquid, having the characteristic odor of nutmeg and a warm, spicy taste. It becomes darker and thicker by age and exposure to the air. Soluble in an equal volume of alcohol. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—1–3 minims (0.06–0.18 Cc.).

Official Preparation.

Spĭritus Myrĭsticæ (5 per cent.)—**Spĭritus Myrĭsticæ—Spirit,** or **Essence, of Nutmeg.**—*Dose,* 15–60 minims (1.0–4.0 Cc.).

Physiological Action and **Therapeutics** are the same as those of anise.

Caryophўllus—Caryophўlli—Cloves. *U. S. P.*

Origin.—The unexpanded flowers of *Eugenia aromatica* (L.) O. Kuntze, a hard-wood, shrubby evergreen. It was originally found in the Molucca Islands, whence it was introduced and cultivated among the East Indian Islands.

Description and Properties.—The buds are about $\frac{5}{8}$ inch (15 Mm.) long, dark-brown, consisting of a subcylindrical, solid and glandular calyx-tube, terminated by four teeth and surmounted by a globular head, formed by four petals covering numerous curved stamens, and one style. A clove resembles a nail (L. *clavus;* Fr. *clou*).

Cloves have a strong aromatic odor and a pungent, spicy taste, and when pressed or scratched emit oil.

Constituents.—Cloves contain about 18 per cent. of a highly pungent volatile oil, 17 per cent. of tannin, and small quantities of fixed oil, gum, resin, etc. Two crystalline principles have been separated: *caryophyllin*, a white, resinous substance—a stearopten—odorless and tasteless; and *eugenin*, a substance soluble in boil-

ing alcohol and isomeric with *eugenol*, a constituent of the volatile oil.

Dose.—5–10 grains (0.3–0.6 Gm.).

Official Preparation.

Tinctūra Lavăndulæ Compŏsita—Tinctūræ Lavăndulæ Compŏsitæ—Tincture of Lavender.—*Dose*, ½–1 fluidrachm (2.0–4.0 Cc.). (Formula given under *Lavender*.)

Ōleum Caryophўlli—Ōlei Caryophўlli—Oil of Cloves. *U. S. P.*

Origin.—A volatile oil distilled from Cloves.

Description and Properties.—A pale-yellow, thin liquid, becoming darker and thicker by age and exposure to the air, having a strongly aromatic odor of cloves and a pungent, spicy taste. Its specific gravity is 1.060–1.067. Soluble in an equal volume of alcohol, the solution being slightly acid to litmus-paper.

Constituents.—Oil of cloves consists of a light and a heavy oil, the former a hydrocarbon, supposed to be inactive; the latter a phenol-like liquid termed *eugenol*, a colorless oil, with the odor of cloves, a specific gravity of 1.076 to 1.0785, yielding with bases crystalline salts. Schenck has demonstrated the presence of salicylic acid in oil of cloves.

Dose.—1–10 minims (0.06–0.6 Cc.).

Allied Compounds and Derivatives.

Bĕnzoyl-eūgenol.—*Origin.*—From Eugenol.

Description and Properties.—It occurs in neutral, odorless, colorless, acicular crystals, having a feebly bitter taste; soluble in hot alcohol, ether, and chloroform, and insoluble in water.

Dose.—Not yet determined.

Cinnămyl-eūgenol.—*Origin.*—A derivative of Eugenol.

Description and Properties.—Colorless, odorless, tasteless, lustrous needles, soluble in hot alcohol, ether, and chloroform, and insoluble in water.

Eūgenyl-acĕtamide.—*Origin.*—Obtained from Eugenol-acetic-ethyl-ether by treating with solution of Ammonia. It occurs as a crystalline powder.

Physiological Action.—*Externally and Locally.*—OIL OF CLOVES is a counter-irritant, local anesthetic, and germicide.

Internally.—Its action is essentially the same as that of anise, it being a powerful carminative and stimulant.

Therapeutics.—*Externally and Locally.*—OIL OF CLOVES is employed as a local anesthetic in *toothache*, *earache*, and *neuralgia*, and as a synergist to other counter-irritants, rubefacients, and anti-

The EUGENOL-ACETAMIDE is a powerful local anesthetic, ılogous to cocaine in its action.

ally.—The therapeutics are similar to those of anise. OYL-EUGENOL has been highly recommended by some prac- ıs a valuable remedy in *tuberculosis*. The author has suc- employed the following combination as an antiseptic and ntative in *gastric fermentation*, to be administered either in ıles, with olive oil as a vehicle, or in the form of an emul-

℞. Olei Caryophylli,
Olei Cinnamomi,
Olei Menthæ Piperitæ,
Creosoti, *aa.* ♏j.

Sig.—Take at one dose.

etter way to administer it is in the form of soft capsules, ıule containing the above dose in about 6 minims (0.37 Cc.) ıil. One or two capsules should be given three times a · meals.

'imĕnta—Piměntæ—Pimenta. *U. S. P.*

(ALLSPICE.)

ı.—The nearly ripe fruit of *Pimenta officinalis* Lindley, an ı tree about 30 feet (9 M.) high, indigenous in the West entral America, and the northern part of South America.

ituents.—The most important constituent is the *volatile* ıich the fruit yields from 3 to 4 per cent.

Piměntæ—Ōlei Piměntæ—Oil of Allspice. *U. S. P.*

ı.—A volatile oil distilled from Pimenta.

iption and Properties.—A colorless or pale-yellow liquid, strong, aromatic, clove-like odor, and a pungent, spicy becomes darker and thicker with age and exposure. equal volume of alcohol it forms a clear solution.

—1–5 minims (0.06–0.3 Cc.).

ological Action and **Therapeutics** are similar to those of

Cajupūti—Ōlei Cajupūti—Oil of Cajuput. *U. S. P.*

ı.—A volatile oil distilled from the leaves of *Melaleuca*

leucadendron L., a tree with crooked stem and scattered branches, resembling the weeping willow, indigenous in the East Indies.

Description and Properties.—A light, thin, bluish-green, or, after rectification, colorless liquid, having a peculiar, agreeable and distinctly camphoraceous odor, and an aromatic, bitterish taste. Specific gravity, 0.922. With an equal volume of alcohol it affords a clear solution, which either has a slightly acid reaction or, in the case of the rectified oil, is neutral to litmus-paper.

Constituents.—The chief constituent is *cajuputol*, the hydrate of the hydrocarbon cajuputene. Cajuputol is identical with eucalyptol.

Dose.—1–5 minims (0.06–0.3 Cc.).

Physiological Action and Therapeutics are identical with those of the oil of cloves.

Cardamōmum—Cardamōmi—Cardamom. *U. S. P.*

Origin.—The fruit of *Elettaria repens* (Sonnerat) Baillon, a perennial plant 6 to 10 feet (1.8–3 M.) high.

Cardamom is indigenous in Hindustan, in the mountainous regions of Malabar.

The same plant furnishes three varieties of cardamoms, known in commerce as the *shorts*, *short-longs*, and *long-longs*.

Description and Properties.—Ovoid or oblong, from $\frac{3}{8}$ to $\frac{1}{2}$ inch (12 Mm.–2 Cm.) long, obtusely triangular, rounded at the base, beaked, longitudinally striate; of a pale-buff color, three-celled, with a thin, leathery, nearly tasteless pericarp and a central placenta. The seeds are about $\frac{1}{5}$ inch (5 Mm.) long and $\frac{1}{8}$ inch (3 Mm.) broad, reddish-brown, angular, rugose, depressed at the hilum, surrounded by a thin membranous arillus. They have an agreeable odor and a pungent, aromatic taste.

The seeds contain 10 per cent. of fixed oil and 4.6 per cent. of a volatile oil, besides albuminous matter, gum, starch, etc. The volatile oil possesses the odor and taste of the seeds, is colorless or yellowish, dextrogyre, contains oxygen, and has a specific gravity of 0.93 to 0.94.

Dose.—5–15 grains (0.3–1 Gm.).

Official Preparations.

Tinctūra Cardamōmi (10 per cent.)—**Tinctūræ Cardamōmi—Tincture of Cardamom.**—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Tinctūra Cardamōmi Compŏsita—Tinctūræ Cardamōmi Compŏsitæ—

Compound Tincture of Cardamom.—Cardamom, 20; Cinnamon, 20; Caraway, 10; Cochineal, 5; Glycerin, 50; Dilute Alcohol, q. s. ad 1000 parts. *Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Pŭlvis Aromăticus—Pŭlveris Aromătici—Aromatic Powder.—Ceylon Cinnamon, 35; Ginger, 35; Cardamon, 15; Nutmeg, 15. *Dose*, 10–30 grains (0.6–2.0 Gm.).

There is also a fluid extract made from this powder. *Dose*, 10–30 minims (0.6–2.0 Cc.).

Antagonists and Incompatibles.—Free acids are incompatible with the compound tincture of cardamom, separating insoluble carminic acid in it.

Physiological Action.—In this respect Cardamom conforms to the general character of the Aromatic Group.

Therapeutics.—Essentially the same as for other members of this group. Cardamom is used principally as an adjuvant to other aromatics, stimulants, stomachics, and carminatives.

Zĭngiber—Zingĭberis—Ginger. *U. S. P.*

Origin.—The rhizome of *Zingiber officinale* Roscoe, a perennial herb indigenous in tropical Asia and now cultivated in most tropical countries.

Description and Properties.—A thick, flattish rhizome from 1 to 4 inches (25 to 100 Mm.) long, with club-shaped lobes on one side; deprived of the corky layer, pale, buff-colored, striate, breaking with a mealy, rather fibrous fracture, showing numerous small, scattered resin-cells and fibro-vascular bundles, the latter enclosed by a nucleus sheath. Agreeably aromatic, and of a warm, pungent taste.

Ginger contains from ¾ to 2 per cent. of a pale-yellow, *volatile oil*, to which the ginger owes its aromatic properties; also a soft *resin*, giving to the drug its hot, pungent taste. The proportion of resin present varies with the different varieties of ginger, that from the East Indies yielding about 8 per cent., while the Jamaica product yields only about 5 per cent.

Dose.—8–30 grains (0.5–2.0 Gm.).

Official Preparations.

Extrăctum Zingĭberis Flūidum—Extrăcti Zingĭberis Flūidī—Fluid Extract of Ginger.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Oleoresīna Zingĭberis—Oleoresīnæ Zingĭberis—Oleoresin of Ginger.—*Dose*, 1–3 grains (0.06–0.18 Gm.).

Pŭlvis Aromăticus—Pŭlveris Aromătici—Aromatic Powder.—*Dose*, 10–30 grains (0.6–2.0 Gm.). (Formula given under *Cardamomum*.)

Pŭlvis Rhēi Compŏsitus—Pŭlveris Rhēi Compŏsiti—Compound Powder of Rhubarb.—Rhubarb, 25; Magnesia, 65; Ginger, 10 parts. *Dose*, ½-1 drachm (2.0–4.0 Gm.).

Sўrupus Zingĭberis—Sўrupi Zingĭberis—Syrup of Ginger.—*Dose*, ½-2 drachms (2.0–8.0 Cc.).

Tinctūra Zingĭberis—Tinctūræ Zingĭberis—Tincture of Ginger.—*Dose*, 1-2 fluidrachms (4.0–8.0 Cc.).

Trochĭsci Zingĭberis—Trochĭscos (acc.) **Zingĭberis—Troches of Ginger.**—*Dose*, use freely as required.

Physiological Action and Therapeutics are almost identical with those of other aromatics. Ginger is especially valuable as a stomachic and carminative, to stimulate the stomach, improve the appetite, and relieve *flatulency* and *colic*. It is a safe and efficient domestic remedy for the relief of *simple diarrhea*. It is also much used as a corrective to modify the taste and action of other medicines.

Călamus—Călami—Calamus. *U. S. P.*

(Sweet Flag.)

Origin.—The rhizome of *Acorus Calamus* L., a plant indigenous in North America, Europe, and Western Asia, growing in swamps and along the shores of streams and ponds.

Description and Properties.—Calamus is found in subcylindrical sections of various lengths, about 1 inch (2 Cm.) broad, externally reddish-brown, internally whitish, of a spongy texture, breaking with a short, corky fracture, showing numerous oil-cells and scattered wood-bundles. It has a strong aromatic, fragrant odor, and a warm, peculiar, bitterish taste. Calamus contains from 1 to 2 per cent. of volatile oil possessing the odor and taste of calamus, a glucosid (acorin) in the form of a bitter, yellow syrupy liquid, besides calamine, choline, resin, starch, and mucilage.

Dose.—15–60 grains (1.0–4.0 Gm.).

Official Preparation.

Extrăctum Călami Flūidum—Extrăcti Călami Flūidi—Fluid Extract of Calamus.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Physiological Action and Therapeutics.—The action of calamus is similar to that of anise, but it is more tonic than the latter. Large doses of the volatile oil produce tetanic convulsions.

It is used for the same purposes as anise, but probably possesses more stomachic and carminative properties.

Ōleum Gaulthēriæ—Ōlei Gaulthēriæ—Oil of Wintergreen. *U. S. P.*

Origin.—A volatile oil distilled from the leaves of *Gaultheria procumbens* L., a small evergreen plant indigenous in the northern hemisphere and bearing a scarlet, fleshy, berry-like fruit.

Description and Properties.—The volatile oil is a colorless or yellow, or occasionally reddish, liquid, having a characteristic, strongly aromatic odor, and a sweetish, warm, and aromatic taste. Specific gravity, 1.175 to 1.185.

It consists almost entirely of methyl salicylate. It should be kept in well-stoppered bottles, protected from light.

Dose.—2–10 minims (0.12–0.6 Cc.).

Official Preparation.

Spīritus Gaulthēriæ—Spīritus Gaulthēriæ—Spirit of Gaultheria (ESSENCE OF WINTERGREEN).—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Physiological Action.—*Externally and Locally.*—Oil of wintergreen is a stimulant and a powerful antiseptic.

Internally.—Its action is identical with that of salicylic acid and its salts, but it does not depress the heart like the latter drugs.

Therapeutics.—*Externally and Locally.*—Used for the same purposes as oil of cloves and other aromatic oils.

Internally.—Used for the same purposes as salicylic acid.

Ōleum Lavăndulæ Flōrum—Ōlei Lavăndulæ Flōrum—Oil of Lavender Flowers. *U. S. P.*

Origin.—A volatile oil distilled from fresh flowers of *Lavandula officinalis* Chaix. Lavender is native to Southern Europe and cultivated in gardens.

Description and Properties.—A colorless or yellowish liquid, having the fragrant odor of lavender flowers and a pungent and bitterish taste. Soluble in all proportions of alcohol. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Spīritus Lavăndulæ (5 per cent.)—**Spīritus Lavăndulæ—Spirit of Lavender.**—*Dose*, ½–1 fluidrachm (2.0–4.0 C.c).

Tinctūra Lavăndulæ Compŏsita—Tinctūræ Lavăndulæ Compŏsitæ—Com-

pound Tincture of Lavender.—Oil of Lavender, 8; Oil of Rosemary, 2; Cassia Cinnamon, 20; Cloves, 5; Nutmeg, 10; Red Saunders, 10; Alcohol, 0.7; Water, 250; Diluted Alcohol, q. s. ad 1000 parts. *Dose*, ½–1 fluidrachm (2.0–4.0 Cc.). Compound Tincture of Lavender is an ingredient of Liquor Potassii Arsenitis.

Physiological Action and **Therapeutics** are the same as those of other volatile oils mentioned in this group.

Mĕntha Piperīta—Mĕnthæ Piperītæ—Peppermint. *U. S. P.*

Origin.—The leaves and tops of *Mentha piperita* Smith, a perennial plant found in damp places in England and other European countries and in North America.

Peppermint contains about 1 per cent. of a *volatile oil*—its most important constituent.

Official Preparation.

Spīritus Mĕnthæ Piperītæ (10 per cent.)—**Spīritus Mĕnthæ Piperītæ**—Spirit, or **Essence, of Peppermint.**—*Dose*, 5–60 minims (0.3–0.4 Cc.).

Spirit of Peppermint is an ingredient of Mistura Rhei et Sodæ.

Ōleum Mĕnthæ Piperītæ—Ōlei Menthæ Piperītæ—Oil of Peppermint. *U. S. P.*

Origin.—A volatile oil distilled from Peppermint.

Description and Properties.—A colorless or yellowish or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic strong odor of peppermint, and a strongly aromatic, pungent taste, followed by a sensation of cold upon inhalation. It forms a clear solution with an equal volume of alcohol, becoming turbid when further diluted, and is soluble in all proportions in carbon disulphide and in glacial acetic acid.

When exposed to a freezing temperature the oil becomes thick and cloudy, and separates crystals of *menthol*, to which it owes its peculiar odor.

Dose.—1–5 minims (0.06–0.3 Cc.).

Official Preparations.

Āqua Mĕnthæ Piperītæ (0.2 per cent.)—**Āquæ Mĕnthæ Piperītæ**—Peppermint Water.—*Dose*, ½–1 fluidounce (15.0–30.0 Cc.).

Trochīsci Mĕnthæ Piperītæ (.01 Cc. in each)—**Trochīscos** (acc.) **Mĕnthæ Piperītæ**—Troches of Peppermint.—*Dose*, freely as desired.

Mĕnthol—Mĕnthol—Menthol. *U. S. P.*

Origin.—A stearopten obtained from the official Oil of Peppermint or from Japanese or Chinese Oil of Peppermint.

Description and Properties.—Colorless, acicular or prismatic crystals, having a strong and pure odor of peppermint, and a warm, aromatic taste, followed by a sensation of cold when air is inhaled. Menthol is but slightly soluble in water, but imparts to the latter its odor and taste. It is freely soluble in alcohol, ether, chloroform, carbon disulphide, and glacial acetic acid.

Dose.—½–2 grains (0.03–0.12 Gm.).

Allied Compounds.

Benzoate of Menthol; Chloral Menthol.—These combinations are quite active local anesthetics and analgesics.

Physiological Action and Therapeutics.—*Externally and Locally.*—MENTHOL is an antiseptic, antipruritic, analgesic, and anesthetic, as well as a germicide. It is used for the same purposes as oil of cloves. It is used extensively in *headache*, being rubbed on the forehead. Owing to its analgesic properties, it is used in the form of an ointment in various strengths for painful *hemorrhoids*, *burns*, *boils*, and *superficial inflammations*.

The OIL OF PEPPERMINT, or MENTHOL, is an ingredient of many sprays and lotions for the treatment of diseases of the *ear*, *nose*, and *throat*.

As an antipruritic MENTHOL is a valuable remedy to relieve the itching of *eczema*, *pruritus*, *urticaria*, etc. It should be dissolved in oil for this purpose—in severe cases 50 grains to 1 ounce (3.2 Gm. to 30.0 Cc.).

Internally.—The uses of OIL OF PEPPERMINT are similar to those of other aromatic oils, it being a valuable carminative, stimulant, antifermentative, and antispasmodic. In small doses MENTHOL has been given to allay *nausea* and *vomiting* and to relieve the pain of *gastralgia*.

Mĕntha Vĭridis—Mĕnthæ Vĭridis—Spearmint. *U. S. P.*

This is one of the mints, found in the same localities as peppermint, and containing, like the latter drug, a volatile oil forming its active constituent. It possesses milder properties than peppermint, although similar to it in its action and uses. To some

people it has a more agreeable taste than peppermint, and in infantile cases it is usually preferred.

Official Preparations.

Āqua Mĕnthæ Vĭridis—Āquæ Mĕnthæ Vĭridis—Spearmint Water.

Spĭritus Mĕnthæ Vĭridis—Spĭritus Mĕnthæ Vĭridis—Spirit, or **Essence,** of **Spearmint.**

The *dose* of the oil of spearmint and of the above preparations is the same as for the corresponding oil and preparations of peppermint.

Thȳmol—Thȳmol—Thymol. *U. S. P.*

Origin.—A phenol or stearopten occurring in, and obtained by, freezing or distilling the volatile oils of *Thymus vulgaris*, *Thymus monarda*, and *Carum ajowan.*

Description and Properties.—Large, colorless, translucent crystals of the hexagonal system, having an aromatic, thyme-like odor, and a pungent aromatic taste, with a very slight caustic effect upon the lips. Its specific gravity as a solid is 1.069, but when liquefied by fusion it is lighter than water. It is soluble in about 1200 parts of water and in less than its own weight of alcohol, ether, or chloroform; also readily soluble in carbon disulphide, glacial acetic acid, and in fixed or volatile oils. When triturated with about equal quantities of camphor, menthol, or chloral, it liquefies.

Dose.—1–5 grains (0.06–0.3 Gm.).

Allied and Derivative Compound.

Thymăcetin, a derivative of thymol, prepared after the manner of phenacetin, and holding the same relation to thymol as phenacetin does to phenol (carbolic acid). It is a white, crystalline powder, sparingly soluble in water. *Dose*, 3–10 grains (0.2–0.6 Gm.).

Physiological Action and *Therapeutics* are similar to those of phenacetin, thymacetin possessing marked analgesic and hypnotic properties.

Physiological Action.—Thymol is a powerful antiseptic, being ten times less poisonous than carbolic acid, yet as an antiseptic far superior to it. While stimulant, it is not irritant or corrosive. It is also a deodorant, disinfectant, parasiticide, and local anesthetic, as well as an antipruritic, antipyretic, and antifermentative.

Absorption and Elimination.—It is eliminated chiefly by the lungs and kidneys, producing some irritation at the points of elimination. The urine is increased in quantity, often assuming a dark greenish hue.

Untoward Action.—The following symptoms have been produced by the administration of large doses: burning sensation in the mouth and stomach, persisting in some instances for days, accompanied by pain and tenderness under pressure. According to Bālz, "perspiration is sometimes observed, and occasionally a transient buzzing in the ears and deafness."

Poisoning.—In addition to untoward manifestations, there may be nausea and vomiting, profuse sweating, great reduction of temperature, dizziness, violent delirium, and collapse.

Therapeutics.—*Externally and Locally.*—The applications of thymol in surgery are identical with those of carbolic acid. Among surgeons who recommend and use it is Mr. Spencer Wells, who employs it in a solution of 1 : 1000 for spray, irrigation, sponges, instruments, and all other antiseptic purposes.

Crocker in 1878 introduced it as an efficient remedy in certain *skin diseases.* It probably owes its value in these cases to its antipruritic and antiparasitic properties.

It is also extensively used in diseases of the *nose, throat,* and *ear,* and in certain disorders of the *genito-urinary tract.* Thymol is also administered by inhalation in certain *broncho-pulmonary disorders.*

Internally.—Thymol is used for the same purposes as other antiseptics, such as carbolic acid, resorcin, beta-naphtol, etc.

Martini highly recommends it as an intestinal antiseptic in the treatment of *diarrhea, dysentery,* and *typhoid fever.*

Bulfalini has employed it with some success in limiting fermentation during a proteid diet in the treatment of *diabetes.* It has also been favorably recommended in *phthisis, vesical catarrh, stomatitis,* and *diphtheria.*

Administration.—It may be applied externally in solution (1 : 1000), as an ointment (1–10 per cent.), or in the form of thymol gauze as a surgical dressing (1 per cent. of thymol).

For internal use it should be given in pills or capsules.

Cārum—Cāri—Caraway. *U. S. P.*

Origin.—The fruit of *Carum Carvi* L., a biennial plant native to Central and Western Asia. It is cultivated in Europe and in the United States.

Description and Properties.—Oblong, laterally compressed, about $\frac{1}{6}$ to $\frac{1}{5}$ inch (4–5 Mm.) in length, tapering somewhat at the

ends, brown, with five yellowish, filiform ribs, and six oil-tubes. Caraway has an agreeable odor and a sweetish, spicy taste.

Constituents.—It contains from 5 to 7 per cent. of a volatile oil.

Dose.—15–30 grains (1.0–2.0 Gm.).

Official Preparation.

Tinctūra Cardamōmi Compŏsita (10 per cent.)—**Tinctūræ Cardamomi Compŏsitæ—Compound Tincture of Cardamom.**—*Dose*, 1–2 fluidrachms (4–8.0 Cc.). (Formula given under *Carāamomum.*)

Ōleum Cāri—Ōlei Cāri—Oil of Caraway. *U. S. P.*

Origin.—A volatile oil distilled from Caraway.

Description and Properties.—A colorless or pale-yellow, thin liquid, having the characteristic aromatic odor of caraway and a mild, spicy taste. Soluble in an equal volume of alcohol, this solution being neutral to litmus-paper.

By fractional distillation the oil may be separated into two portions: a light hydrocarbon with but little odor and taste, *carvene*, and a heavy oil having an agreeable caraway odor, *carvol*, and isomeric with menthol, myristicol, and thymol.

Dose.—1–10 minims (0.6–0.66 Cc.).

Official Preparation.

Spĭritus Junĭperi Compŏsitus (0.05 per cent.)—**Spĭritus Junĭperi Compŏsitus—Compound Spirit of Juniper.**—Oil of Juniper, 4; Oil of Caraway, ½; Oil of Fennel, ½; Alcohol, 0.7; Water, q. s. ad 1000 parts. *Dose*, 2–4 fluidrachms (8.0–15.0 Cc.).

Physiological Action and Therapeutics.—The same as those of the other aromatic oils.

,ASS II.—SYMPTOM MEDICINES.

GROUP I.—ANTISPASMODICS.

ısmodics are remedies used to allay spasm and quiet xcitement or improve unfavorable conditions of the in cases of convulsions, hysteria, melancholia, hypo-, etc. They act as stimulants to the brain and higher nters, and as depressants of the lower centers, diminish-lar activity and, partly through their action upon the vous centers, increasing the co-ordinating power. They onsiderable degree cardiac stimulants, diaphoretics, ex- and antiseptics.

ˈcĕtida—Asafœ̆tidæ—Asafetida. *U. S. P.*

—A gum resin obtained from the root of *Ferula fœtida* egel, a large perennial herb found in Turkestan, Western l Western Afghanistan.

ɔtion and Properties.—Irregular masses composed of ırs imbedded in a yellowish- or brownish-gray, sticky e tears when hard break with a conchoidal fracture, milk-white color, which changes, on exposure, to pink, to brown. The drug has a persistent alliaceous odor r, alliaceous, acrid taste. When triturated with water it lk-white emulsion, which becomes yellow upon the addi-monia water. It is partly soluble in ether, and at least ıt. of it should dissolve in alcohol.

·5–8 grains (0.3–0.5 Gm.).

Official Preparations.

ı **Asafœ̆tidæ—Emŭlsi Asafœ̆tidæ—Emulsion of Asafetida.**—*Dose,* ıs (7.39–15 Cc.).

loes et Asafœ̆tidæ—Pĭlulas (acc.) **Ăloes et Asafœ̆tidæ.—Pills of safetida.**—*Dose,* 2 to 5 pills.

.safœ̆tidæ—Pĭlulas (acc.) **Asafœ̆tidæ—Pills of Asafetida.**—*Dose,*

Asafœ̆tidæ—Tinctūræ Asafœ̆tidæ—Tincture of Asafetida (20 *ose,* 10–40 minims (0.6–2.5 Cc.).

Ammoniacum—Ammoniaci—Ammoniac. U.S.P.

Origin.—A gum resin obtained from *Dorema Ammoniacum* Don, a plant 6 to 7 feet (2 M.) high, found in the deserts and barren regions of Persia and Tartary.

Description and Properties.—Reddish tears, ¼–1 inch (0.5–2.5 Cm.) in diameter; externally pale yellowish-brown, internally milk-white, brittle when cold, and breaking with a flat, conchoidal, and waxy fracture; or the tears are superficially united into irregular masses without any intervening dark-colored substance. It has a peculiar odor and a bitter, acrid, and nauseous taste. When triturated with water it readily yields a milk-white emulsion. It contains from 1.5 to 4 per cent. of volatile oil, 70 to 72 per cent. of resin, and 18 to 22 per cent. of gum.

Dose.—2–10 grains (0.12–0.6 Gm.).

Official Preparations.

Emplastrum Ammoniaci cum Hydrargyro—Emplastra Ammoniaci cum Hydrargyro—Ammoniac Plaster with Mercury.—For external use.

Emulsum Ammoniaci—Emulsi Ammoniaci—Emulsion of Ammoniac (4 per cent.).—*Dose*, ½–1 fluidounce (15 to 30 Cc.).

Camphōra—Camphōræ—Camphor. U. S. P.

Origin.—A stearopten (of the nature of a ketone) obtained from *Cinnamomum camphora* L., and purified by sublimation. The camphor laurel is a handsome tree 25 to 30 feet (7.5–9 M.) high, indigenous in Eastern and Southeastern Asia, and cultivated in Italy as an ornamental tree.

Description and Properties.—White, translucent masses, of a tough consistence and crystalline structure, readily pulverizable in the presence of a little alcohol, ether, or chloroform; having a penetrating, characteristic odor and a pungently aromatic taste. Very sparingly soluble in water, but readily soluble in alcohol, ether, chloroform, carbon disulphide, benzin, and in fixed and volatile oils.

When camphor is triturated in about molecular proportions with menthol, thymol, phenol, or chloral hydrate, liquefaction ensues. It melts at 175° C. (347° F.), boils at 204° C. (399.2° F.), and is inflammable, burning with a luminous, smoky flame. On exposure to the air it evaporates more or less rapidly at ordinary temperatures, and when moderately heated it sublimes without leaving a residue.

From camphor may be obtained a number of interesting compounds, such as *camphoric acid, cymol,* etc. The drug should be kept in well-closed vessels, in a cool place.

Dose.—2–10 grains (0.12–0.6 Gm.).

Official Preparations.

Āqua Camphōræ—Āquæ Camphōræ—Camphor Water (0.8 per cent.).—*Dose,* ½–2 fluidounces (15–30 Cc.).

Linimĕntum Camphōræ—Linimĕnti Camphōræ—Camphor Liniment.—Camphor, 20; Cotton Seed Oil, 80 parts. For external use.

Linimĕntum Sapōnis—Linimĕnti Sapōnis—Soap Liniment (4.5 per cent.).—For external use.

Spĭritus Camphōræ—Spĭritus Camphōræ—Spirit of Camphor (10 per cent.).—*Dose,* 5–40 minims (0.3–2.6 Cc.).

Tinctūra Ōpii Camphorāta—Tinctūræ Ōpii Camphorātæ—Camphorated Tincture of Opium (0.4 per cent.).—*Dose,* 1–4 fluidrachms (4–15 Cc.).

Camphōra Monobromāta—Camphōræ Monobromātæ—Monobromated Camphor. *U. S. P.*

Origin.—Prepared by heating Camphor and Bromine, dissolving in Benzin, and crystallizing from hot Alcohol.

Description and Properties.—Colorless, prismatic needles or scales, of a mild, camphoraceous odor and taste, permanent in the air, unaffected by light, and neutral to litmus-paper. Almost insoluble in water; freely soluble in alcohol, ether, chloroform, hot benzin, and fixed and volatile oils; slightly soluble in glycerin.

Dose.—2–5 grains (0.12–0.3 Gm.).

Ăcidum Camphŏricum—Ăcidi Camphŏrici—Camphoric Acid.—*Origin.*—Obtained by the oxidation of Camphor through the action of Nitric Acid.

Description and Properties.—White, acicular crystals, odorless, and of a weak, acid, and slightly astringent taste. Soluble in hot water, alcohol, ether, and fatty oils; almost insoluble in cold water.

Dose.—10–30 grains (0.6–2.0 Gm.).

Valeriāna—Valeriānæ—Valerian. *U. S. P.*

Origin.—The rhizome and roots of *Valeriana officinalis* L., an herbaceous perennial 2 to 4 feet (0.6–1.2 M.) high, a native of Europe, and cultivated to some extent in New England and New York.

Description and Properties.—The rhizome varies in length between ½ and 1¼ inches (1–3 Cm.), and has nearly an equal diameter, thick, upright, subglobular or obconical, truncate at both ends, brown or yellowish-brown, internally whitish or pale-brownish,

with a narrow circle of white wood under the thin bark. Roots numerous, slender, brittle, brown, with a thick bark and slender, ligneous cord. Odor peculiar, becoming stronger and unpleasant on keeping; taste camphoraceous and somewhat bitter.

Valerian contains *valerianic* and other acids and a volatile oil.

Dose.—15–60 grains (1.0–4.0 Gm.).

Official Preparations.

Extrăctum Valeriānæ Flūidum—Extrăcti Valeriānæ Flūidi—Fluid Extract of Valerian.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Tinctūra Valeriānæ—Tinctūræ Valeriānæ—Tincture of Valerian (20 per cent.).—*Dose*, 1–2 fluidrachms (4–8 Cc.).

Tinctūra Valeriānæ Ammoniāta—Tinctūræ Valeriānæ Ammoniātæ—Ammoniated Tincture of Valerian (20 per cent.).—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Ammōnii Valeriānas—Ammōnii Valerianātis—Ammonium Valerianate. *U. S. P.*

Origin.—Obtained by saturating Valerianic Acid with Gaseous Ammonia and crystallizing.

Description and Properties.—Colorless or white quadranguiar plates, emitting the odor of valerianic acid; of a sharp and sweetish taste; deliquescent in moist air. Very soluble in water and in alcohol. Ammonium valerianate should be kept in well-stoppered bottles.

Dose.—2–10 grains (0.12–0.6 Gm.).

Fĕrri Valeriānas—Fĕrri Valerianātis—Ferric Valerianate. *U. S. P.*

Origin.—Prepared by mixing solutions of Ferric Sulphate and Sodium Valerianate and washing the precipitate formed.

Description and Properties.—A dark brick-red amorphous powder of somewhat varying chemical composition, having the odor of valerianic acid and a mildly styptic taste; permanent in dry air. Insoluble in cold water, but readily soluble in alcohol. Ferric valerianate should be kept in small, well-stoppered bottles, in a cool and dark place.

Dose.—1–3 grains (0.6–0.2 Gm.).

Zĭnci Valeriānas—Zĭnci Valerianātis—Zinc Valerianate. *U. S. P.*

Origin.—Obtained by evaporating hot solutions of Zinc Sul-

ıd Sodium Valerianate, the zinc valerianate crystallizing

ription and Properties.—White, pearly scales, having the valerianic acid and a sweetish, astringent, and metallic n exposure to air it slowly loses valerianic acid. Soluble in ıo parts of water and in 40 parts of alcohol. It should be ısmall, well-stoppered bottles.

.—½–3 grains (0.03–0.2 Gm.).

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gonists and Incompatibles.—The actions of ASAFETIDA, ıC, and CAMPHOR are opposed by arterial sedatives, acids, :ral salts, while quinine, digitalis, and ergot antagonize the f VALERIAN.

:r and aqueous solutions precipitate CAMPHOR from its alco- ution.

rgists.—The antispasmodics are synergistic to each other. e also aided in their action by the aromatics and many of resins and balsams, alcohol, ether, etc.

e remedies are so nearly alike in their action that their ıgical effects will here be considered as a whole, mention ıade of any marked difference in their individual action it exist.

iological Action.—*Externally and Locally.*—The only of this group having any special local action is CAMPHOR. ıg has an anesthetic effect upon the unbroken skin, but in ıtrated state is very irritating to mucous membranes, and n produce inflammation and sloughing. CAMPHOR is also ful parasiticide.

ıtive System.—In medicinal doses antispasmodics stimulate stion and augment the secretions from the gastro-intestinal They also stimulate peristalsis, and are active carminatives ıatives to the digestive tract. ASAFETIDA is the most laxa- ll.

e doses of any antispasmodic cause nausea, vomiting, and CAMPHOR being the most irritant, and in toxic doses acting itant poison.

these drugs exert their most potent action. They are all stimulants to some portion of the cerebrum. Their precise influence upon the brain is, however, unknown, and in order to form a better conception of the action of these drugs some explanation of the function of the brain is necessary.

The cerebrum consists of a complex mechanism, each localized area having a definite physiological function, the relations of the several areas differing one from another, some being equal and others subordinate. These areas probably are—1. Perception areas —five; 2. Judgment areas; 3. Emotion areas; 4. Motor areas; 5. Inhibitory areas. These areas are all connected by commissural fibers.

The emotion and motor areas are controlled by the functional influence of the areas of inhibition. Sometimes disturbing influences modify this adjustment, so that the lower areas act independently. The perturbation may be due either to deficient power of inhibition, to unusual activity of the lower areas, or to lack of co-ordination in the connecting fibers by which the unimpeded areas are held in subjection. Even a slight loss of command occasions in the subject an irritability readily aroused, together with annoyance from trivial causes which under normal conditions would be inconsequential. The mental derangement accompanying these phenomena we call nervousness, and when the symptoms become still further aggravated the mental disturbance known as hysteria results.

Again, the emotion and cerebral motor areas may become so far freed from restraint that even violent hysterical symptoms ensue, including convulsions or coma. Obviously, therefore, the only remedy for the malady is to restore the equilibrium between the inhibitory and lower areas.

This may be effected either by stimulation of the debilitated areas of inhibition, by depression of the over-active lower areas, or by supplying a possible deficiency in the conductive force of the fibers. The first of these desiderata may be attained by improving the circulation and affording stronger nutriment. By dilating the arterioles small doses of alcohol and ether accomplish this object, and may act favorably in an attack of hysteria. Alcohol, however, in large doses exerts a deleterious influence by causing exceeding depression of the central nervous system, resulting in incoherence. Arsenic, quinine, cod-liver oil, and iron by their tonic effects may, under continued dosage, abort access of hysteria.

remedial agents which tend to act directly upon the cell-
ɛture of the inhibitory areas, and thereby invigorate them,
rugs under consideration—the antispasmodics. By stim-
ıf the inhibitory centers they may allay the spasms of

norbid activity of the lower areas may be ameliorated by
ıt remedies, among which morphine and the bromides may
rticularly beneficial.

ıntispasmodics, it will be seen, appear to exert a calmative
upon certain nerve-centers, allaying nervous excitement
ıcular spasm. They produce a gentle, exhilarating effect
: brain, and diffuse a feeling of warmth in the system. It
ɔd that they also possess mildly aphrodisiac properties.
'e doses, on the other hand, may occasion delirium, even
in maniacal excitement, this being particularly true of
:, toxic doses of which drug, in the monobromated form,
ıscular weakness, passing into paralysis, followed by stupor
apse. VALERIAN may occasion formication of the hands
and a condition of melancholia.

'ratory System.—The antispasmodics are all respiratory
ts and stimulant expectorants. Large doses of MONO-
ɪD CAMPHOR depress respiration.

'ption and Elimination.—These drugs are readily absorbed
ɛ stomach or rectum, and are eliminated by the intestinal
ıneys, lungs, skin, and mucous membranes generally, stim-
ıe glands in these structures, and, in the case of ASAFETIDA
ERIAN, imparting the characteristic odor of these drugs to
retions.

'erature.—Unaffected except by MONOBROMATED CAMPHOR,
n large doses acts as a depressant.

ıs.—The menstrual flow and sexual appetite are increased
, continued dosage, however, has a depressing effect upon
ıerative functions, CAMPHOR perhaps being the most active
ɛ doses.

s said that the sexual passion of cats is extraordinarily
l by valerian, probably because of its odor.

'oward Action.—CAMPHOR may occasion mental confusion,
:he, vertigo, dryness of the mouth and thirst, flushing of the
lammy perspiration, disturbances of digestion, and strangury.
produces similar untoward manifestations, with a sense of
ɪre in the eye-sockets and marked sexual excitement. The

symptoms caused by VALERIAN are very much the same, although, as in the untoward action of ASAFETIDA, there is more disturbance of the gastro-intestinal tract, such as nausea, borborygmi, diarrhea, and colicky pains. Barbier noted visual hallucinations in a person treated with VALERIAN.

Poisoning.—The symptoms of poisoning resemble the untoward action, save that the effects may be more marked, with greater irritation of the intestinal tract and more pronounced cerebral disturbance.

Treatment of Poisoning.—Coffee and the arterial sedatives antagonize the action of CAMPHOR. The patient should be treated symptomatically; emetics or the stomach-pump should be employed, and measures taken to favor elimination. Excessive nervous manifestations may be controlled by opium or the bromides.

Therapeutics.—*Externally and Locally.*—The only member of the present group used locally is CAMPHOR, its anesthetic and antipruritic properties rendering it of great value in the treatment of diseases of the skin. "Anderson's powder," composed of pulverized camphor, starch, and zinc oxide, is a very soothing and efficient dusting powder in *erythema*, *erythematous eczema*, and *urticaria*. "Camphor-ice" and ointments of camphor, alone or combined with salicylic acid, are used for "*chapped hands*," *ulcers*, etc.

Various inhalants and powders containing camphor have been successfully employed in the treatment of *ozena*, *acute coryza*, and *laryngitis*. SUPPOSITORIES OF CAMPHOR afford great relief in cases of *chordee*, while the CAMPHOR LINIMENT is a household remedy for *sprains*, *bruises*, *chilblains*, etc.

CAMPHOR CHLORAL makes an efficient local application in *neuralgia*, and the CAMPHO-PHENIQUE is an excellent antiseptic, when mixed with oil being an efficient dressing for *wounds*.

Internally.—The disagreeable odor and taste of many of the antispasmodics—notably asafetida, valerian, and musk—greatly limit their use. ASAFETIDA is an exceedingly valuable stomachic tonic, and singularly beneficial in the *atonic dyspepsia* and *constipation* of nervous and anemic women. It stimulates the appetite and digestion, acts as a laxative, and allays much of the nervousness and melancholia from which these patients so frequently suffer.

ASAFETIDA is a peculiarly potent remedy in relieving *paroxysms of hysteria*, and there is probably no more effective agent for the alleviation of *flatulent colic* of infants and various *infantile convulsions*.

bronchitis and ***bronchorrhea***, especially when attended
odic dyspnea, are very favorably influenced by this rem-
ıntispasmodic action renders asafetida of considerable
hooping cough and the *sympathetic cough of mothers.*
has been highly recommended in *chorea* occurring in
s about the age of puberty, who are weak, anemic, and
om menstrual irregularities. The emulsion of asafetida,
ı enema, often affords prompt and complete relief in the
of typhoid fever.

IACUM is chiefly employed as a stimulant expectorant in
nchitis. CAMPHOR is a remarkably efficient anodyne, an-
:, and carminative in *flatulent colic, diarrhea of infants,*
rrhea of the aged produced by relaxation of the bowels.
years camphor has been considered a valuable remedy
·hea ushering in an attack of *Asiatic cholera.*

ious spasmodic and hysterical disorders for which asa-
commended are also greatly benefited by camphor. It
er, a serviceable stimulant expectorant and a potent
pecially MONOBROMATED CAMPHOR, to allay *sexual excite-*
for the relief of *chordee.* It has likewise proved effica-
ermatorrhea.

especially the puerperal form, *delirium tremens*, and
z have occasionally been benefited by full doses of
The internal use of the drug has appeared to prove
n *senile gangrene.*

orrhea and the *after-pains* of labor are greatly relieved
ır, either alone or combined with morphine. The drug
ısed extensively as a cardiac stimulant and to allay the
d restlessness of *typhoid, typhus*, and *exanthematous fevers.*

ORIC ACID is an efficient remedy in checking the *night-*
phthisis and *excessive perspiration* in *acute rheumatism.*
mended by Wood in *enuresis* and *spermatorrhea.* While
cient as camphor or monobromated camphor in spas-
hysterical disorders, it has proved of some benefit in
litions.

oric acid in from 1 to 2 per cent. solution is useful in
ent of *acute pharyngitis* and *acute coryza*, being employed
ı of a gargle or spray.

oric acid has been used internally to acidify ammoniacal
titis.

AN has been employed for the same class of disorders as

those treated with asafetida, but seems to be superior to the latter in mitigating the *hysterical manifestations* and *vaso-motor disturbances* occurring at the *menopause*.

The *hypochondriasis* of feeble and morbidly sensitive girls and women is usually soon relieved by this remedy. *Nervous headache* and *vertigo* due to cerebral anemia and the irregular distribution of blood are, in the majority of cases, promptly relieved by valerian or the ammonium valerianate.

Valerian has been favorably recommended in both *diabetes insipidus* and *mellitus*.

Contraindications.—There are no special contraindications to the use of antispasmodics other than in acute inflammations of the gastro-intestinal tract, when camphor should not be employed.

Administration.—Any of the preparations of the various members of this group may be used. Asafetida and camphor in substance should always be given in the form of pills or capsules. Camphoric acid is best administered in capsules.

GROUP II.—ANTIPYRETICS.

Acetanilīdum[1]—Acetanilīdi—Acetanilid.

Origin.—An acetyl derivation of Aniline.

Description and Properties.—White, shining, micaceous, crystalline laminæ, or a crystalline powder, odorless, faintly burning taste, permanent in air, neutral to litmus-paper. It is soluble, at 15° C. (59° F.), in 194 parts of water, 5 parts of alcohol, 18 parts of boiling water, and in 0.4 part of boiling alcohol; also in 18 parts of ether, and easily soluble in chloroform.

Dose.—2–10 grains (0.1–0.65 Gm.).

Physiological Action.—*Externally and Locally.*—Antiseptic, slightly sedative.

[1] *Antifebrin* is a copyrighted name for *Acetanilid*, or *Phenyl-acetamide*, as it is sometimes called. The copyrighted word *Antifebrin* should never be used. The proprietary preparations like *Antikamnia*, *Antinervin*, *Phenolyd*, *Exodyne Ammonol*, etc. are said, by different chemists who have analyzed them, to be mechanical mixtures of *Acetanilid* and one or more such substances as *Sodium Bicarbonate*, *Caffeine*, *Ammonium Bromide*, *Salicylic Acid*, *Sodium Salicylate*, etc. Such secret preparations should not be countenanced by medical men. Should a combination containing some of the aforesaid drugs be desired, a prescription for the same should be written, specifying the proportions wanted in each particular case, rather than prescribe a proprietary article costing a dollar or more an ounce, the same mixture being put up by any pharmacist for ten cents an ounce.

ally.—Digestive System.—Non-irritating, sedative; medic-
s sometimes allay nausea.

atory System.—In therapeutic doses acetanilid appears to
action upon the blood. The corpuscles are unaffected
e influence of small doses, but toxic doses disorganize the
s. When large doses are taken, or even small doses by one
n idiosyncrasy against the drug, the arterial blood becomes
a character, the normal alkalinity of the blood is decreased,
a of the hemoglobin is reduced to methemoglobin.

and Blood-vessels.—In medicinal doses the arterial ten-
lightly raised, while the heart is slowed. Toxic doses
lepress the heart and vaso-motor mechanism, causing an
e fall of arterial pressure and great cardiac depression.

us System.—In medicinal doses acetanilid is a sedative to
ry nerves and spinal cord. Small doses are mildly stim-
the brain, and under certain conditions the drug is a
Toxic doses result in general anesthesia and abolition
es, with paralysis of motor and sensory nerves.

atory System.—Medicinal doses produce no special effect.
xic doses are given there is a rapid and labored respiration.
produced by respiratory failure, due to direct action of the
on the respiratory center, and indirectly by greatly de-
he oxygen-carrying power of the blood and by paralyz-
eripheral motor nerves.

tion and Elimination.—Acetanilid is an active diuretic, in-
he excretion of urea, and to some extent the excretion of
After toxic doses have been taken the urine becomes dark
ish in color, from the presence of disorganized corpuscular
of the blood. It is diaphoretic. Acetanilid is chiefly elim-
the kidneys in the form of sulphate of para-amido-phenol.

rature.—Acetanilid has little or no effect on the normal
perature; but if the latter is above normal, the drug has
l antipyretic action, often reducing the temperature to
rmal. This peculiar effect of acetanilid, and of the anti-
roup in general, is due primarily to the action of the
he heat-center in the medulla. When the body is in a
yperpyrexia the heat-center is in a depressed condition,
certain poisons circulating in the blood, and will not
o the normal limit (98.6°) of body temperature. Acetani-
es the irritability of the heat-center, causing it to respond
r temperature, and, through its action on the vasomotor

center, stimulates the vasodilators, thereby augmenting the peripheral circulation, with consequent increase of heat-dissipation.

Eye.—Medicinal doses have no apparent influence on the eye. Toxic doses have produced contracted and motionless pupils.

Untoward Action.—Under prolonged use of acetanilid congestion of the liver, kidneys, and spleen occurs. Paroxysms of sneezing have apparently been induced by a medicinal dose, and, under the same, redness of the skin, chilliness, and cyanosis have sometimes ensued.

Poisoning.—The skin is cyanosed, the face is livid and anxious, and the body is covered with cold sweat. There may be vomiting; the pulse is soft, slow, and weak, accompanied by profound prostration. The respirations are first rapid and labored, and later slow and very shallow, death resulting usually from respiratory paralysis. After death the heart, liver, and kidneys are found in a state of acute fatty degeneration.

Treatment of Poisoning.—Diffusible stimulants, like alcohol, in small doses, ammonia, and sulphuric ether. Coffee, atropine, and strychnine hypodermically as circulatory and respiratory stimulants. External heat and, if necessary, oxygen inhalations to overcome cyanosis.

Therapeutics.—*Externally and Locally.*—Acetanilid has been locally applied for the treatment of *chancre* and *chancroid*, but there are other antiseptics which are generally considered to be more satisfactory. It is quite an active hemostatic, and may be used in *epistaxis* and *hemoptysis.*

Internally.—The use of acetanilid in fevers has been practically abandoned by the great majority of clinicians. If an antipyretic of this character is indicated at all, it is in *sthenic fevers*, and then to be used only with great care. Its tendency to cause cardiac depression, profuse sweating, and collapse renders its use harmful, if not unsafe, in low conditions like *typhoid fever* and advanced *phthisis.* It may often be administered with good effect in the first stage of *pneumonia.* The headache, fever, and other unpleasant symptoms in the *exanthemata* are greatly modified by its use, although when this drug is given to children they must be very carefully watched to avoid untoward effects.

There is considerable difference of opinion in regard to the utility of acetanilid in *rheumatism.* Some authorities believe that it exercises a most favorable influence in the acute articular variety, being less apt to disturb the brain than salicylic acid or its salts. The

drug certainly mitigates, and often entirely relieves, the pain and swelling, while it reduces the fever. Like salicylic acid, it has no power to prevent heart-complications, but, on the contrary, it should be used with great care, if at all, when such complications exist. It has no tendency to prevent relapses.

The dose of acetanilid in acute rheumatism should not exceed 6 grains (0.5 Gm.) three times a day.

Acetanilid is a very efficient analgesic, and the introduction of this drug, antipyrine, and other remedies of this character has enabled us to relieve the pains of certain *spinal diseases* more efficiently than was possible before.

The crises of *locomotor ataxia* are often promptly relieved by acetanilid. *Neuralgias* of every kind indicate its use. The pains of *neuritis*, *lumbago*, *gastralgia*, *dysmenorrhea*, *sciatica*, *tabes dorsalis*, and nearly every kind of *headache* usually yield to its analgesic influence.

In many cases of *chorea* and *epilepsy* (especially the diurnal variety), and in those cases characterized by full habit and high arterial tension, the drug has often been employed successfully.

Pains which are paroxysmal in character yield best to acetanilid. It quiets the excitement in *mania a potu*, and frequently lessens the paroxysms of *whooping-cough*.

In doses of 3–5 grains (0.2–0.32 Cc.), thrice daily, acetanilid has proved efficient as a relief for *sea-sickness*. It has also been found serviceable in traumatic *tetanus*.

The author has found it to be of great value in *influenza*, or "*la grippe*," combined or given alternately with salol or sodium salicylate. It is also highly praised in *acute bronchitis*.

Contraindications.—In low fevers, at any rate not in repeated doses; in fatty or dilated heart, blood disorders, advanced tubercular disease, and exhaustion from hemorrhages.

Administration.—It may be prescribed in powders, pills, compressed tablets, capsules, or alcoholic solution. A speedier effect is produced if it is taken dissolved in a small quantity of alcohol or wine diluted with water.

The average dose as an antipyretic usually should not exceed 5 grains (0.3 Gm.); as an anodyne, 2–5 grains (0.1–0.3 Gm.). It may be repeated at intervals of about four hours or less, according to its effects.

Its action in neuralgias, according to Hare, may be assisted by associating it with small doses of monobromated camphor.

Antipyrīna—Antipyrīnæ—Antipyrine.

Origin.—A Coal-tar derivative.

Description and Properties.—A white, crystalline powder, odorless, of a slightly bitter taste, freely soluble in water, alcohol, and chloroform.

Dose.—3–20 grains (0.19–1.3 Gm.).

Antagonists and Incompatibles.—Antipyrine is incompatible with spirit of nitrous ether and nitrous compounds, the chlorides of mercury, the iodides of arsenic and mercury, the ferric salts in solution, tincture of iodine, most of the vegetable astringents, carbolic acid, chloral, beta-naphtol, sodium bicarbonate, sodium salicylate, and the salts of quinine and caffeine.

Synergists.—The same as for other members of this group.

Physiological Action.—*Digestive System.*—Antipyrine differs from acetanilid in that it often produces vomiting.

Respiratory System.—In medicinal doses it increases the number of respiratory movements. In every other respect it has the same action upon the respiration as acetanilid.

Absorption and Elimination.—Kidneys.—Antipyrine lessens the amount of urine, urea, and uric acid excreted, but increases the amount of sulphuric acid in the urine. Like acetanilid, toxic doses cause the urine to assume a dark or brownish color. It is more rapidly eliminated than acetanilid, being detected in the urine within three hours after being taken.

Eye.—Toxic doses have produced amblyopia and hallucinations of vision.

Therapeutics.—The remarks on the therapeutics of acetanilid are applicable to this drug, although antipyrine is a more powerful antiseptic, analgesic, and local anesthetic. As an analgesic it probably ranks next to opium. The anesthesia produced by antipyrine often lasts for several hours or even days. In acute *coryza* and *inflammation of the pharynx* great relief is obtained by spraying the parts with a 2 or 4 per cent. solution, after applying a solution of cocaine to prevent the primary smarting and irritation which the antipyrine produces.

A 20 per cent. solution has been used in *otitis*, and a 4 per cent. solution has been found very efficient in *cystitis*.

Antipyrine has been used with some success in *diabetes mellitus* and *malarial diseases*, particularly in *intermittent fever*. It does not, however, possess the antiperiodic and specific action of quinine in malarial poisoning. It is an excellent antispasmodic in whooping-cough, laryngitis, and asthma.

Administration.—The drug is best given in water or some aromatic water or syrup. It may also be given hypodermically. In hemorrhage the powdered drug may be applied locally, or a 40 per cent. solution, which causes less irritation. From ½–2 grains (0.03–0.12 Gm.), once or twice a day, is sufficient for children. Ordinarily a dose of 5 grains (0.3 Gm.) is sufficient for an adult.

Phenăcetin.

Origin.—A Coal-tar derivative.

Description and Properties.—A colorless, odorless, tasteless powder, or glistening, scaly crystals, sparingly soluble in cold water, more or less soluble in boiling water, and freely soluble in 16 parts of rectified spirits.

Dose.—1–10 grains (0.06–0.6 Gm.).

Physiological Action.—Phenacetin differs from acetanilid only in the following respects:

Circulatory System.—Small doses *increase* the force of the heart, accelerate the pulse, and raise arterial tension. Large doses affect the blood and the circulatory system like acetanilid.

Kidneys.—It is a diuretic, but not so active as acetanilid. When large doses have been taken the urine is dark-yellow in color and gives the reaction for sugar.

As an antipyretic phenacetin is said to be slower in its action than acetanilid, nor is it so powerful as an analgesic and hypnotic.

By many physicians the drug is considered one of the safest of the synthetical antipyretics, though in very large doses, according to Hare, it is more apt to disintegrate the blood than either antipyrine or acetanilid. It certainly has an advantage over many other antipyretics in being tasteless, seldom exciting nausea, excessive diuresis, diaphoresis, or diarrhea. The author's experience leads him to consider it as possessing a briefer antithermic action and a greater tendency to produce cyanosis and rigors than acetanilid or antipyrine.

Therapeutics.—Phenacetin is given in the same class of diseases as acetanilid.

Contraindications.—The same as for acetanilid.

Administration.—The drug may be dispensed in powders, pills, capsules, tablets, or suspended in mucilaginous drinks.[1]

[1] Phenacetin may be adulterated with phenacetidin, a by-product in manufacture and a poisonous substance, which in small doses induces kidney trouble. Many of the toxic

Phēnocoll.

Origin.—A combination of Para-amido Phenocoll and Glycocoll. The *phenocoll hydrochloride* is the salt used in medicine.

Description and Properties.—A white crystalline powder, soluble in 16 parts of water, and freely soluble in hot alcohol, forming a neutral solution.

Dose.—3–15 grains (0.2–1.0 Gm.).

Incompatibles.—All the alkalies.

Physiological Action.—Phenocoll differs from acetanilid in no essential particulars other than the following:

Circulatory System.—Its effect upon the heart and pulse is similar to that of acetanilid, but it has no influence upon the blood itself.

Kidneys.—The excretion of nitrogen in the urine is increased.

Temperature.—In febrile conditions it produces a decided fall of temperature within one hour after its administration by the stomach, caused by an enormous diminution of heat-production without any marked alteration of heat-dissipation.

Therapeutics—Experience with phenocoll hydrochloride is yet too limited for us to draw any trustworthy conclusions as to its safety compared with the antipyretics previously mentioned or regarding its real place in medicine. The results, thus far, have shown it to be comparatively safe—probably the safest of all antipyretics—and of value internally for all conditions benefited by the previously named antipyretics. It is not so valuable an antipyretic and analgesic in *rheumatism* as acetanilid or antipyrine, nor is it so efficient an analgesic in *myelitis*, *sciatica*, or *neuralgia;* but, on the other hand, it far surpasses these drugs in the treatment of *intermittent fever*, ranking next to quinine in malarial disorders.

Pelletini, indeed, regards it as superior to all antimalarial remedies, and Bonetti considers it a real substitute for quinine.

symptoms of acetanilid so closely resemble aniline-poisoning as to suggest the production of that substance in the blood. There is a close relationship between the two bodies, and there is some ground to suspect the occasional presence of aniline in samples. The important question of adulteration and impurity should not be lost sight of in considering the ill effects of any drug. In the experience of the author, better results, in every particular, have been obtained from antipyrine than from either of the other antipyretics mentioned, so that he almost invariably uses it, both for adults and children, believing it the safest drug of its class, as well as the most certain and uniform in its action.

These drugs are unquestionably given in too large doses by the majority of physicians, and persons suffering from high temperature are more susceptible to their untoward influences—like cyanosis, collapse, etc.—than those whose temperature is normal.

Phenocoll possesses the advantage of not producing the unpleasant effects of quinine. It is a powerful antiseptic, and may be applied locally where a drug of that character is indicated.

Contraindications.—Probably the same as for acetanilid.

Administration.—Locally, the drug may be employed in solution or in the form of an ointment in strengths varying from 5 to 20 per cent. Internally it may be administered, in the doses recommended, from three to five times a day, in powders, aqueous solution, or in capsules.

Exălgine (Methylacetănilide).

Origin.—As the chemical name indicates, this substance is a derivative of Acetanilid.

Description and Properties.—Exalgine occurs in colorless needles or prisms, inodorous and tasteless. It is neutral to test-paper, and is freely soluble in alcohol, chloroform, carbon disulphide, and boiling water. It requires about 60 parts of cold water or 10 parts of ether for solution.

Dose.—2–4 grains (0.1–0.2 Gm.).

Antagonists and Incompatibles.—Exalgine is incompatible with the iodides, salicylic acid, and solution of potassa.

Synergists.—All members of this group, as well as opium, cocaine, belladonna, and hyoscyamus.

Physiological Action.—Exalgine is almost identical in its action with acetanilid, with the exception that it possesses less antipyretic power. In medicinal doses the drug increases arterial tension, and in full doses profoundly affects the cerebro-spinal axis. It is more uncertain than, and not so safe as, either of the drugs previously mentioned.

Therapeutics.—Exalgine should never be employed as an antipyretic, but as an analgesic it may be given for the same purposes as acetanilid and antipyrine. Good results have been reported in the treatment of *chorea* by this drug.

Contraindications.—The same as for other agents of this group, and, in addition, fever, it is said, contraindicates its use.

Administration.—Exalgine may be administered either in powders or capsules, but the doses should not be given at frequent intervals, from six to seven hours elapsing between them, and only in exceptional cases should more than 10 grains (0.16 Gm.) be given in twenty-four hours.

GROUP III.—ANESTHETICS.

As heretofore defined, these are substances having the property of destroying sensation, or producing anesthesia, either general or local.

To Dr. Oliver Wendell Holmes is due the credit of proposing the term "anesthetic." This group naturally occupies the place between the preceding one and the next—Hypnotics. As before stated, there exists a close chemical relationship between antiseptics, antipyretics, anesthetics, hypnotics, and analgesics. The first two of these possess marked anesthetic and analgesic properties. The drugs included in the present group should properly be classed as general anesthetics, possessing more nearly the characteristics of typical anesthetics.

We quote the following, from F. Lauder Brunton's *Introduction to Modern Therapeutics:*

"The use of drugs to abolish pain in surgical operations has probably never been entirely forgotten, but their general and systematic employment only commenced with the use of nitrous oxide by Wells, in 1844, and of ether by his pupil Morton. Shortly afterward a great number of substances were tried by Simpson, with the result that he chose chloroform as being the most convenient and safe. The power of producing anesthesia, or perhaps I should say, more definitely, the power not only to abolish pain and thus render an operation unfelt by the sufferer, but to abolish reflex action, so that the surgeon may be able to operate more easily, is common to most of the substances of the fatty or alcoholic series. But it is greatly modified by two circumstances: (1) the position in the fatty or alcoholic group of the radical or alkyl which forms the basis of the substance; and (2) the nature of the element or radical with which the alkyl is combined .... Thus in the case of the alkyls, their action differs according as they are combined with hydrogen in the hydrides, with hydroxyl, OH, in the alcohols, or with both oxygen and hydroxyl, as in the acids.

"Moreover, both their physical condition and physiological action may be changed by replacing hydrogen by other elements. Thus, if we replace three atoms of hydrogen in marsh-gas, CH_4, by chlorine, which has an atomic weight of 35.5, while that of hydrogen is only 1, we convert the light gas with a molecular weight of 16 into the heavy liquid chloroform, with a molecular weight of 119.5. If in place of three atoms of chlorine, we introduce three of iodine, each having a weight of 127, the molecular weight of the whole compound becomes 394, and in place of a

permanent gas like marsh-gas, or a heavy fluid like chloroform, we get a solid like iodoform.

"The physical condition of the substance may be influenced by the number of atoms of other elements which combine with an alkyl as well as by their nature. Thus, when only one atom of hydrogen in methane, CH_4, is replaced by chlorine, the resulting monochlormethane, CH_3Cl, or methyl chloride, is a gas at ordinary temperatures, although it can be condensed by cold and pressure to a liquid which boils at 22° C. Dichlormethane, or methylene chloride, CH_2Cl_2, is a heavy liquid boiling at 41° C.; and trichlormethane, or chloroform, $CHCl_3$, is a still heavier liquid, which boils at 61° C. It appears, then, that we can increase the atomic weight of an anesthetic and render it more solid by adding carbon to the alkyl, or by replacing hydrogen with heavier atoms like chlorine or iodine. The more hydrogen atoms are thus replaced the denser does the body become, so that it may pass from a gas to a liquid, and then to a solid at ordinary temperatures.

"It is probable, as I have said, that all the substances belonging to the alcoholic series possess the power of abolishing to a greater or less extent the excitability of all the nerve-centers within the body. They appear to act upon those centers in the inverse order of their development, destroying first the functional activity of the highest ideational and volitional centers in the cerebrum, those centers which are the latest to be developed, and which not only raise man above the animals, but raise individual men above their fellows. As their action increases, nerve-centers of a lower development are affected, or, as Hughlings Jackson puts it, the most highly organized centers are affected first, while the lowest, most simple, and at the same time most automatic and stable centers are affected last. The perceptive and motor ganglia, the reflex centers of the cord, the vasomotor and respiratory centers, and the heart, all become paralyzed when the action of the members of this group is pushed to its utmost extremity.

"But they are not all rendered inactive in the same order by each member of the group. On this account some members are useful as hypnotics, simply inducing sleep as one of the first results of their action; although if the dose be large, the sleep may pass into complete unconsciousness or anesthesia, with loss of reflex action. For the production of prolonged sleep we require a substance whose action will be slight, and at the same time prolonged; but for anesthesia we require a substance that will act rapidly and powerfully, but will be quickly eliminated and cease to act

very shortly after its administration is discontinued. We therefore look for hypnotics among the substances which have a heavy molecule, and are either liquid or solid in form, so that they may be given by the mouth, and being absorbed into the blood continue to act for a length of time. We look for our anesthetics amongst the lower members of the series which have a light molecular weight, and are either gases or volatile liquids. Although heavy liquids like paraldehyde, or solids like chloral hydrate, will act as anesthetics when given in large doses, yet their use as such would be very dangerous, for the line between their anesthetic action and their paralyzing action on the respiratory center is very narrow, and might easily be crossed by very slight excess in dose. The elimination of such substances being slow, we cannot at once get rid of their effects of excess in the same way as we can in the case of those which, like ether, enter the lungs as vapor and are readily eliminated."

An ideal agent of this description should be a substance capable of rapidly and safely producing profound anesthesia, and susceptible of speedy elimination, so that consciousness may be restored soon after withdrawal of the anesthetic, with no discomfort to the patient.

The typical anesthetic should also be convenient and safe—a stable, non-irritating, pleasantly odorous, homogeneous liquid, with a boiling-point neither too high nor too low. Unfortunately, there is no substance which fully meets these requirements, ether and chloroform approaching nearest to the ideal agent.

The general anesthetics, with the exception of nitrous oxide, all belong to the class of alcohols and ethers. Indeed, alcohol, although in this work not classed among anesthetics, possesses marked anesthetic properties, as well as others—antiseptic, antipyretic, etc.—characteristic of these drugs.

It has been stated by Dr. Richardson that the first recorded case of the use of an anesthetic in surgery was that of Dr. Collier in 1839, who anesthetized his patient by causing him to inhale the fumes of alcohol.

It has been well known for centuries that alcohol, when taken in large quantities, possesses the power to lessen pain and sensation. The anesthesia produced by this drug, however, is too tardy and prolonged to render it practically serviceable.

General anesthetics abolish sensation throughout the whole body by destroying the sensibility of the nerve-centers—directly, by affecting the *nervous tissue*, or indirectly, by influencing the *circulation*, or the *blood*, in such a manner as to interfere with the functional activity of the nerve-cells.

The detailed action and uses of anesthetics are fully described under "Æther" and "Chloroformum."

Local anesthetics are used to deaden the sensation or abolish the sensibility of the peripheral nerves of a localized, particular area. The most important are—cocaine, carbolic acid, iodoform, eugenol-acetamide, and antipyrine. Some aromatics are also quite powerful anesthetics. The physiological action of local anesthetics is given under the respective agents.

Æther—Ætheris—Ether. *U. S. P.*

Origin.—A liquid composed of about 96 per cent. by weight of Ether or Ethyl Oxide, and about 4 per cent. of Alcohol containing a little Water.

Ether is known as sulphuric ether, and was called *Æther Fortior* by the Pharmacopœia of 1880.

Description and Properties.—A transparent, colorless, mobile liquid, having a characteristic odor and a burning, sweetish taste. Specific gravity, 0.725–0.728. Soluble in about ten times its volume of water, with slight contraction of bulk. Miscible, in all proportions, with alcohol, chloroform, benzin, benzol, and fixed and volatile oils.

Ether is highly volatile and inflammable, its vapor, when mixed with air and ignited, exploding violently. It should be kept in well-stoppered containers, preferably in tin cans, in a cool place, remote from lights or fire.

Dose.—15–40 minims (1.0–4.0 Cc.).

Official Preparations.

Spiritus Ætheris—Spiritus Ætheris—Spirit of Ether.—*Dose*, ¼–1 fluidrachm (1.0–4.0 Cc.).

Spiritus Ætheris Compŏsitus—Spiritus Ætheris Compŏsiti—Compound Spirit of Ether (HOFFMANN'S ANODYNE).—Ether, 325; Alcohol, 650; Ethereal Oil, 25 parts. *Dose*, 5–60 minims (0.3–4.0 Cc.).

Antagonists and Incompatibles.—The stimulant and anodyne action of ether is antagonized by the arterial sedatives, the tetanizing alkaloids, strychnine, picrotoxin, etc.

Synergists.—The arterial and cerebral stimulants, chloroform and other anesthetics, and alcohol.

Physiological Action.—*Externally and Locally.*—Ether when applied to the skin produces intense cold by its rapid evaporation. If it is confined and its evaporation prevented, great irritation is

excited. By spraying a part with ether it becomes quickly frozen, marked local anesthesia being produced thereby.

Applied to mucous membranes, it creates considerable irritation, especially of the fauces and respiratory tract when inhaled.

Internally.—Digestive System.—It is a carminative, increasing peristalsis and the secretions from the pancreas and the salivary and gastric glands, at the same time dilating the vessels of the stomach.

Circulatory System.—When taken into the stomach ether reflexly stimulates the heart in a manner similar to that of alcohol, raising arterial tension by increasing the force and frequency of the heart's action.

Ether stimulates the heart and increases the blood-pressure when inhaled. It is a diffusible, rapid, and reliable cardiac stimulant. In very large or poisonous amounts it exhausts the heart by over-stimulation, acting as a cardiac depressant.

Nervous System.—Ether first occasions a considerable degree of excitement, due to the direct action of the ethyl upon the cerebral cortex. Its action in this respect is analogous to that of alcohol, and, like the latter drug, it affects the nervous system in a certain order, primarily stimulating and afterward depressing, first, the cerebral hemispheres; second, the sensory areas of the spinal cord; third, the motor areas of the spinal cord; fourth, the sensory centers of the medulla oblongata; and, finally, the motor areas of the medulla. The motor nerves and muscles are unaffected.

Respiratory System.—Medicinal doses stimulate and poisonous doses paralyze the respiratory center.

Respiration is frequently arrested at the beginning of ether-inhalation, owing to reflex spasm arising from irritation of the peripheral ends of the vagi and trigemini. As the inhalation is continued the breathing becomes deeper and faster from stimulation of the respiratory center. This part of the nervous system may, in fact, become exhausted from over-stimulation, when the respirations are slow and shallow.

In fatal cases of ether-narcosis the respiration is usually arrested before the cessation of the heart's action.

Absorption and Elimination.—Ether is rapidly eliminated, chiefly by the lungs, but also by the kidneys, which are often considerably irritated by the process.

nperature.—The prolonged administration of ether produces
t reduction of temperature—doubtless due to the depression

of the circulation and respiration and the rapid evaporation of the drug chilling the body and lungs, rather than to any direct action upon the nervous mechanism presiding over the heat-centers.

In brief, the action of ether when inhaled is as follows: At first a sensation of choking and irritability of the respiratory mucous membrane is experienced. A greatly increased activity of the salivary glands follows, accompanied by a sensation of pricking or tingling of the hands and feet. The conjunctiva is injected, the face is flushed, the veins of the neck are distended, and there is experienced a peculiar feeling of lightness, together with a perversion of all the senses, due to emotional excitement. The patient may yell, laugh, cry, curse or pray, struggle or become pugilistic, while the breathing may be spasmodic or stertorous, the pulse becoming rapid and strong.

As the inhalation is continued the respiration is quickened, the skin becomes moist and warm, and relaxation of the muscles ensues, with abolition of reflexes, contracted pupils, and complete suspension of sensation. Finally, as perfect unconsciousness supervenes, the pupils are dilated; the respiration is slow and deep, and later very weak; and the skin is cool and moist.

If the inhalation be discontinued before a toxic quantity of ether has been administered, consciousness gradually returns—in some cases almost at once, although some loss of sensation and muscular weakness remain for a while.

The return of consciousness is usually accompanied by retching and vomiting—often by severe rigors, unless care has been taken to keep the patient warm. Great excitement not infrequently attends this stage of etherization.

Treatment of Untoward Manifestations.—Withdraw the ether if there be danger of respiratory or cardiac failure, lowering the head if there be indications of the latter, and if respiratory failure be threatened, as indicated by cyanosis, avoiding a prostrate position. Meanwhile, other measures for the relief of cardiac or respiratory failure may be resorted to: artificial respiration, friction, or the electric current to excite respiratory action, one electrode being placed upon the larynx and the other upon the epigastrium. Hypodermic injections may be resorted to—of strychnine, digitalis, or atropine, or, in desperate cases, of ammonia.

When asphyxia is produced by the lodgement of mucus in the respiratory passages, the hypodermic injection of ether itself is permissible, if necessary, to excite more vigorous respirations.

Should nausea become too persistent, a hypodermic injection of morphine will usually suffice to quiet it.

Ice-water or a little ether poured over the epigastrium will establish regular respirations when suspended, as is often the case, during the first stage of anesthesia.

Therapeutics.—*Externally and Locally.*—The hypodermic injection of 15 minims (1.0 Gm.) of ETHER in close proximity to the affected nerve has been found valuable in *neuralgia* and *sciatica.*

The hypodermic method of administration has been also practised in the treatment of *shock* and in the threatened collapse following *post-partum hemorrhage*, as well as for the cure of *sebaceous cysts.*

The local anesthetic properties of ether render it valuable in many diseases of the *skin*, such as *pruritus*, *urticaria*, etc. For treatment of these disorders it is usually combined with some aromatic.

A wet compress saturated with ether has been successfully applied to the forehead for the relief of *epistaxis.*

Internally.—ETHER is used as an antispasmodic in order to facilitate certain examinations, the *reduction of dislocations*, and to relieve *pain* in the general practice of surgery, obstetrics, and dentistry.

It has been used as an anthelmintic against *tape-worms.*

THE COMPOUND SPIRIT OF ETHER is a stimulant, antispasmodic, and anodyne. It is an efficient remedy for *gastralgia* and *flatulent colic*, and is used to allay many of the symptoms of *hysteria*, as well as *restlessness* and *insomnia* unaccompanied by fever. *Palpitation of the heart* and *nausea* due to the excessive use of tobacco are also greatly benefited by this preparation. In *angina pectoris* and *hiccough* it is an efficient remedy.

Contraindications.—Acute or chronic disease of the kidneys. Dilatation or fatty degeneration of the heart. Disease of the lungs. Tumors of the brain or about the neck. Atheromatous condition of the arteries. Enlarged tonsils, chronic alcoholism, or aneurysm.

It is necessary at times to give an anesthetic in the foregoing cases, and the surgeon is justified in the use of ether, but the administration should be extremely careful and conducted under skilful supervision whenever the above contraindications exist—particularly in conditions of dilated or fatty heart or chronic alcoholism.

Administration.—In administering anesthetics the following precautions should be taken:

The stomach of the patient should contain no undigested food.

The clothing should be loose about the neck, thorax, and abdomen, allowing perfect freedom of respiration.

Artificial teeth should be removed.

It should be remembered that ether is inflammable, and, when its vapor is mixed with air, explosive: it should, therefore, not be used near a flame or an actual cautery, from which it may ignite.

The patient should be kept covered, in order that there may not be too great a reduction in temperature. He should, moreover, be watched for several hours after the administration, since there is always more or less danger until the effects of the ether have entirely disappeared.

Under proper methods the administration of ether occasions little inconvenience. In addition to the recommendations above given, it may be added that smearing the mouth and nose with oil prevents the excoriation frequently occasioned by contact with the anesthetic.

There are various means of administration, the simplest and in many cases the most efficient being a towel shaped into a funnel or hollow cone, with a piece of stiff paper laid between the outer folds to preserve the shape. Among many mechanical contrivances the inhaler of Dr. O. H. Allis of Philadelphia is perhaps the best. At the Massachusetts General Hospital a cone-shaped sponge is employed.

In using the towel-cone the inner surface is saturated with about half an ounce of ether, the inhaler at first not being placed close to the mouth and nose, thus allowing the vapor to be sufficiently diluted with air. The effect of this method is to accustom the air-passages to the primary irritation of the anesthetic and graduate its effects. After this the towel may be pressed close to the mouth and nose and the concentrated ether freely administered. In this manner a person may become completely etherized without nausea or resistance. The insensibility of the conjunctiva and complete relaxation of the muscles, accompanied by semi-stertorous breathing, indicate that the stage of desirable anesthesia is attained. The quantity of ether administered should now be reduced, further supplies being limited to the amount requisite to maintain complete anesthesia.

The symptoms incident to the primary effects of etherization—

cerebral excitement, muscular activity, etc.—should not induce withdrawal of the anesthetic, but rather its continuance. Should vomiting occur at this stage, etherization should be suspended and the mouth thoroughly cleansed by means of a sponge or a towel.

Complete loss of consciousness marks the following stage of anesthesia, when total relaxation supervenes, accompanied by gentle, regular breathing. Should stertorous respiration attend further etherization, it is a warning of paresis, and the drug should be withdrawn.

Congestion of the facial muscles during anesthesia is quite normal, pallor, as a rule, indicating cardiac or respiratory debility. The practice of closely covering the face is thus to be discouraged, since it conceals important symptoms of the patient's physiological condition. The danger from asphyxia in complete etherization is shown by the entire muscular relaxation of the tongue, which is prone to drop backward, and the closing of the glottis, suspending respiration. In such an occurrence the jaw should be pressed forward, the head being well extended, and, if necessary, the tongue brought forward with the forceps.

Under favorable conditions from five to twelve minutes are required to etherize the patient completely. The effects of anesthesia upon recovery vary with the temperament and character of the individual and the conditions under which the drug is administered. Great excitability may attend awakening from etherization, or the patient may return to consciousness as from a tranquil slumber. Nausea and vomiting frequently accompany rallying from the narcosis—not, however, such as may require especial treatment. Should somnolence be manifested, it is best not to rouse the patient, that the awakening may be easy and natural.

In etherizing a female patient the presence of a woman is always desirable, in order that her testimony may assuage certain abnormal impressions to which women during anesthesia are prone, the hallucinations being more readily dispelled by one of their own sex. To the operator and attendants her presence is also of importance.

Great care should be taken to see that the patient is well covered and not exposed to drafts, in its relaxed condition the body being peculiarly susceptible to pneumonia or pleurisy. The anesthetic should be carefully examined before administration, and the character of the drug thoroughly known.

Chlorofŏrmum—Chlorofŏrmi—Chloroform. *U. S. P.*

Origin.—A liquid consisting of from 99 to 99.4 per cent., by weight, of Absolute Chloroform, and from 1 to 0.6 per cent. of Alcohol.

Description and Properties.—A heavy, clear, colorless, mobile, and diffusible liquid, of a characteristic ethereal odor and a burning taste. Specific gravity, not below 1.490. Soluble in about 200 times its volume of cold water, and in all proportions in alcohol, ether, benzol, benzin, and fixed and volatile oils.

Chloroform is volatile, even at a low temperature, and boils at 60° to 61° C. (140°–141.8° F.). It is not inflammable, but its heated vapor burns, emitting a green flame. It should be kept in dark, amber-colored, glass-stoppered bottles, in a cool and dark place.

(See tests for chloroform in U. S. Pharmacopœia, p. 88.)

Dose.—2–15 minims (0.12–1.0 Cc.).

Official Preparations.

Āqua Chlorofŏrmi—Āquæ Chlorofŏrmi—Chloroform Water.—*Dose*, 1–4 fluidrachms (4.0–16.0 Cc.).

Emŭlsum Chlorofŏrmi—Emŭlsi Chlorofŏrmi—Chloroform Emulsion.—*Dose*, 1–4 fluidrachms (4.0–16.0 Cc.).

Liniměntum Chlorofŏrmi—Liniměnti Chlorofŏrmi—Chloroform Liniment.—For external use. Chloroform, 30; Soap Liniment, 70 parts.

Spĭritus Chlorofŏrmi—Spĭritus Chlorofŏrmi—Spirit of Chloroform.—*Dose*, 10 minims–1 fluidrachm (0.6–4.0 Cc.).

Unofficial Preparations.

Chlŏrodyne.—This preparation was first introduced by Dr. Collis Browne of London. Numerous formulæ for *chlorodyne* have been published, the British Pharmacopœia containing an official preparation, *Tinctura Chloroformi et Morphinæ*, intended as a substitute for chlorodyne, and composed of chloroform, ether, alcohol, morphine hydrochlorate, dilute hydrocyanic acid, oil of peppermint, fluid extract of liquorice, treacle, and syrup. *Dose*, 10 minims (0.6 Cc.). Parke, Davis & Co. of Detroit, Mich., prepare a similar and excellent compound known as *Chlor-Anodyne*.

The different preparations of chlorodyne and its substitutes vary greatly in the dose, from 5 minims to 1 fluidrachm (0.3–4.0 Cc.); in prescribing, therefore, the strength of the agent should be ascertained. Remedies of this character possess powerful narcotic, anodyne, and antispasmodic properties, and should be administered cautiously and only under the direction of a physician.

In addition to the above, there is an efficient carminative and antispasmodic known as *Tinctura Chloroformi Composita* (B. P.)—*dose*, 20 minims–1 fluidrachm (1.2–4.0 Cc.)—containing chloroform and compound tincture of cardamom and various anesthetic mixtures; and chloroform ointments of different strengths.

Antagonists and Incompatibles.—Chloroform will not mix with weak spirits or glycerin. Circulatory and respiratory stimulants and galvanism antagonize to some extent its poisonous action. There is no chemical antidote.

Synergists.—Anesthetics, alcohol, morphine, chloral, and many of the hypnotics.

Physiological Action.—*Externally and Locally.*—Its action is similar to that of ether, though when confined on the skin it produces vesication. It is more of an irritant to mucous membranes than ether, yet when inhaled it is less irritating to the respiratory tract.

Internally.—Digestive System.—Its action upon the digestive tract is nearly identical with that of ether, except that when taken in a concentrated form it occasions marked irritation of the stomach and intestines, often resulting in violent gastro-enteritis.

Circulatory System.—Chloroform depresses the heart and circulation, the former by weakening the cardiac muscle, and the latter by lowering arterial pressure by depressing the vaso-motor center. It frequently produces an intermittent pulse by stimulating the inhibitory ganglia of the heart.

Nervous System.—It affects the brain and spinal cord in the same manner and order as ether, like it producing death, usually by respiratory failure, though sometimes the heart first succumbs to the influence of the drug.

When locally applied the sensory and motor nerves are affected in the same manner as by ether. Small amounts of chloroform stimulate, and large quantities depress, the nervous system.

Respiratory System.—Its action closely resembles that of ether, though its operation is more rapid and powerful.

Absorption and Elimination.—Chloroform affects the kidneys by irritation, certain investigators claiming that acute nephritis ensues, blood and albumin being often present; it is certainly less irritating than ether.

Temperature.—It depresses the temperature, although probably by a different action from that of ether, reducing bodily temperature by lessening heat-production and increasing heat-dissipation.

Untoward Action.—If there be any marked idiosyncrasy against chloroform, death usually occurs suddenly after a few inhalations of the drug.

When applied externally there is produced not infrequently an urticaria-like eruption or an eczematous condition of the skin; vesicles may result. If applied to sensitive portions of the skin, such as the scrotum, severe and persistent pain is sometimes occa-

sioned. Frequently, when applied to wounds and mucous membranes, it causes intense irritation, so much so that the mucous membrane may be shed in pieces.

The symptomatic manifestations of chloroform-anesthesia, the methods of administration, and the treatment of chloroform accidents are here given in detail.

The phenomena attending the administration of chloroform indicate three separate stages of narcosis. The first of these is allied to intoxication induced by alcoholic stimulants. In this stage, although sensation is dulled, consciousness is retained, and, although the period is brief as a rule, in some patients, such as those of intemperate habits, it may last for some time and be accompanied by violent excitement. In such cases the administration of chloroform is attended with no little danger.

The second stage, available for surgical operations, is one of complete anesthesia. The patient is perfectly passive, consciousness and sensation being for the time wholly obliterated.

The third stage is the most delicate to deal with, profound unconsciousness, with stertorous breathing and total muscular relaxation, as well as temporary annihilation of reflexes, indicating the danger-line of anesthesia. Only under extreme necessity should the administration be carried thus far.

It is well to guard against taking the pulse as an infallible guide to the patient's condition. In each successive stage the cardiac movements are variable, although, generally speaking, certain pulsations accompany the above-named degrees of narcosis.

As has been suggested in the case of ether, a few precautions in the administration of chloroform are obvious—that there be no undigested food in the stomach; that the clothing be loose about the neck, chest, and abdomen; and that artificial teeth be removed.

The appliances used in producing anesthesia by the aid of chloroform are various, the simplest, as in the administration of ether, being a cone formed of a napkin or a towel enclosing a sponge or not, a sponge alone, or a handkerchief, upon which a small quantity of chloroform—not exceeding from a half to one fluid-drachm (2.0–4.0 Cc.) at a time—is poured. The utmost vigilance is requisite in the administration, the respiration, pulse, and facial indications being constantly observed; a supply of air being allowed to mingle with the anesthetic to obviate the dangerous effect of its concentrated vapor; and the drug being instantly withdrawn upon the slightest indication of untoward symptoms,

such as lividity of the face, debility of heart-pulsations, and stertorous or spasmodic respiration, and an ominous dilatation of the pupils.

Should respiration cease, the tongue should immediately be brought forward or the lower maxillary manipulated as in the case of ether. Should these resources be unavailing, artificial respiration or the galvanic current should be tried. To restore cardiac action nitrite of amyl may be used, or hypodermic injections of ammonia or digitalis as a cardiac stimulant.

A mixture of ether and chloroform has been suggested by competent authorities as the safest and most efficient anesthetic. Yet its utility in many cases has proved doubtful, experience in operative surgery rather inclining to the use of a single agent.

Although the symptomatic features of chloroform-narcosis, especially those which accompany collapse and death, have been studiously examined, the conditions causing disaster are still but imperfectly understood. Nevertheless, premonitory indications are seldom wanting which mark clearly enough the limit of safety in administration. Of these, extreme mydriasis and failure to produce reflex action in the conjunctiva are alone symptoms to be regarded with the gravest apprehension.

The statistics of deaths from chloroform present a melancholy yet instructive spectacle to the thoughtful physician, and the deductions drawn from them go far to show the value of exceeding caution in the use of so subtle and powerful an anesthetic. The pathological considerations of any given case fail to throw light upon the immediate cause of the patient's collapse, the cessation of respiration or stoppage of the pulse resulting in syncope or asphyxia varying in their mutual order and coincidences.

It is not to be inferred that chloroform is of itself necessarily dangerous, its noxious effects depending upon its administration rather than upon the drug. An instance of its harmless use is found in the method of producing partial and temporary anesthesia adopted by some physicians in cases of childbirth, neuralgia, etc., by which the patient is permitted to administer the anesthetic. This method consists in saturating with chloroform a small sponge placed in a cup or tumbler, and allowing the patient to inhale the fumes at will. Before the system can absorb a lethal quantity of the drug muscular relaxation intervenes and the hand involuntarily drops, the semi-conscious state meanwhile dulling sensation and causing the patient to forget pain. Upon the return of conscious-

ness the administration may be repeated, with little danger of untoward results from the small amount of chloroform inhaled. The bottle, it is hardly necessary to say, should never be entrusted to the patient.

ADDITIONAL ANESTHETICS, AND THEIR COMPARATIVE VALUE.

Ethyl Bromide.—A colorless, inflammable liquid, with a burning taste and an odor like that of chloroform. It is readily decomposed, with evolution of bromine. Its action is uncertain, causing great irritation of the respiratory passages, and usually producing death by paralysis of respiration.

Ethyl Chloride.—A volatile, colorless, and inflammable liquid having a pleasant odor. It is a very fugacious anesthetic, greatly depressing the heart and respiration, and is mainly used, in the form of a spray, to produce local anesthesia.

Ethyl Iodide.—A liquid anesthetic, similar in its physiological action to chloroform. Anesthesia produced by it, however, is more tardy, although more permanent. It is considered a comparatively safe and efficient anesthetic to relieve spasm of the respiratory passages, as in asthma and laryngitis.

Ethylene Bichloride.—More rapid and powerful in its action than chloroform, though not so safe, affecting the respiratory center invariably before influencing the heart. While speedier in its action than ether, it is probably more dangerous.

Ethylene Bromide.—A weak yet dangerous anesthetic, greatly depressing the respiratory center, and tending to cause paralysis of the extremities and stoppage of the heart.

Ethylidene Chloride.—A non-inflammable liquid resembling chloroform in its physical appearance, and in its physiological action as well, although much less depressant to the heart. It causes more irritation to the respiratory passages, with vomiting and great languor and discomfort as its sequelæ.

Ethylene Iodide.—A crystalline substance, its fumes when heated producing anesthesia, with great irritation of the respiratory passages, and death by asphyxia.

Methyl Chloride.—A colorless, inflammable gas, with a taste and odor resembling those of ether and chloroform. Cold liquefies it. It is used locally to produce anesthesia and to relieve pain in neuralgia.

Methylene Bichloride.—A colorless liquid, its odor being like that of chloroform. Exposure to the light decomposes it. Anes-

thesia produced by this agent is accompanied with comparatively little irritation of the respiratory tract, but it occasions a primary stage of excitement like that induced by ether, and, as in the case of chloroform administration, vomiting is likely to ensue. Death takes place from paralysis of the heart. The numerous fatalities which have occurred under this anesthetic indicate the danger of its use, and its volatility renders its employment difficult in a hot atmosphere.

Carbon Tetrachloride—Tetrachlormethane.—A transparent, colorless liquid, of an agreeable aromatic flavor, analogous in its action to chloroform, but less irritating, although far more dangerous to the heart.

Formic Ether.—A thin, colorless, inflammable liquid, of strong, agreeable odor and pungent taste. It acts like chloroform, though the signs of asphyxia are less marked. Its effects last for several hours.

Methylic Ether.—A colorless, inflammable gas, heavier than air, of an ethereal odor and aromatic taste. Richardson considers it a safe anesthetic, though objectionable because of its odor—less agreeable than those of ether and chloroform—and the rapidity with which it volatilizes from its solution.

Methylal—Methylen—Dimethyl Ether.—A highly volatile, colorless, limpid liquid, of penetrating ethereal odor. It is used chiefly as a local anesthetic and as an efficient hypnotic in insanity and delirium tremens.

Acetic Ether (U. S. P.).—A colorless, limpid, volatile liquid having an agreeable, refreshing, ethereal, and somewhat acetous odor and taste. It has the advantage over sulphuric ether of being less inflammable and less volatile. Owing to its pungent and agreeable odor, too, it is superior to the latter drug in stimulating the nasal passages in cases of syncope and nervous agitation.

Pental.—A colorless, volatile, inflammable liquid, insoluble in water, but miscible in all proportions with alcohol, ether, and chloroform. It has a mustard-like odor, and is comparatively free from danger. When poisonous amounts are administered the pulse is quickened, the respiration embarrassed, and death ensues from paralysis of the heart. It resembles chloroform rather than ether, but is less irritating and seldom accompanied by unpleasant after-effects. It requires but about 5 drachms (20.0 Cc.) to produce anesthesia, which occurs in from two to three minutes.

There is a difference of opinion as to the safety of pental, some

physicians considering it less dangerous than chloroform, and others regarding it as less efficient and not so safe.

Nitrous Oxide ("Laughing Gas").—A colorless gas, of a very slight, agreeable odor and sweetish taste. It is not inflammable, but supports combustion of ignited bodies. Pressure and cold condense it into either a thin, colorless, very mobile liquid or colorless crystals. It is a rapid anesthetic, unconsciousness being produced in from one-half a minute to three minutes. The pulse is strong and quick, the respirations frequent and shallow, while, as the inhalation continues, the breathing becomes stertorous and the face is cyanotic. If the inhalation be interrupted or the gas mixed with air, symptoms of intoxication are manifested, accompanied by a high degree of mental excitement. It is a very safe anesthetic, but the anesthesia is of quite short duration, rendering it valuable mainly for the extraction of teeth and in minor surgery.

The comparative value of ether and chloroform may be summarized as follows:

1. If an anesthetic be required, ether is preferable in the case of a patient suffering from a weak cardiac action or an organic disease of the heart.

2. For operations about the face or of the stomach, as there is less danger of reflex inhibition of the heart, ether is preferable to chloroform.

3. Ether is preferable as an anesthetic in the extraction of teeth, chloroform being more apt to cause cardiac paralysis, reflexly by way of the dental nerve to the root of the vagus, and through the vagus to the inhibitory ganglia of the heart-muscle.

4. Ordinarily, ether is superior to, and safer than, chloroform as an anesthetic for adults, unless some special contraindication exist, there being less danger in ether of cardiac failure, to which adults are more liable.

Chloroform is much superior to ether in—

1. Obstetrics, since the use of it is attended with less depression and irritation of the respiration and respiratory tract. Moreover, chloroform produces less nausea and vomiting, and may be administered by the patient herself under proper directions.

2. It is preferable in anesthetizing children, being more rapid in its action and less potent as a respiratory depressant, the respiratory center of the child being more susceptible than that of the adult, and in children the danger of cardiac paralysis being slight.

3. Should the patient be suffering from nephritis, chloroform is preferable as an anesthetic, since it is less irritating to the kidneys.

4. Should an anesthetic be required for patients afflicted with pulmonary tuberculosis, empyema, or other disease of the lungs, chloroform should be used, since its effect upon the respiratory system is less depressing.

GROUP IV.—HYPNOTICS.

Chlōral—Chlorālis—Chloral. *U. S. P.*

Origin.—A crystalline solid composed of Trichloraldehyde or Chloral (an unstable, oily, and colorless fluid), with 1 molecule of Water, forming the *Hydrate of Chloral*, the official preparation, and the only one used in medicine. Chloral itself is prepared by the action of Chlorine upon Alcohol, whence the name *chlor-al.*

Description and Properties.—Chloral hydrate occurs as separate, rhomboidal, colorless, transparent crystals, having an aromatic, penetrating, and slightly acrid odor, and a bitterish, caustic taste. It is slightly volatilized when exposed to the air, and is freely soluble in water, alcohol, and ether, being also soluble in chloroform, benzol, benzin, carbon disulphide, and fixed and volatile oils. It liquefies when triturated with an equal quantity of camphor, menthol, thymol, or carbolic acid.

Dose.—5–20 grains (0.3–1.2 Gm.).

Unofficial Preparations.

The proprietary preparation known as **Bromĭdia** contains to each drachm (4.0 Cc.) 15 grains (1.0 Gm.), each, of Chloral and Potassium Bromide, together with a small quantity of Extract of Hyoscyamus and Extract of Cannabis Indica.

Camphorated Chloral.—Equal parts of Chloral and Camphor. A colorless liquid, of syrupy consistence, soluble in alcohol, ether, chloroform, glycerin, and fixed oils, and also in aqueous solutions of chloral. It is decomposed by water, chloral hydrate being dissolved and camphor precipitated.

Chloral-glycerite is prepared by dissolving 1 drachm (4.0 Gm.) of Chloral in 4 drachms (15.0 Cc.) of Glycerin, being used as a solvent for powerful alkaloids.

Chloral-phēnol.—Prepared by triturating equal parts of Chloral and Carbolic Acid. It occurs as a colorless, viscid liquid, with a sweet caustic taste. Used externally.

Allied Compounds.

Ămylene Hydrate.—A tertiary alcohol, the chemical name being *dimethylethylcarbinol.*

Description and Properties.—It occurs as a limpid, colorless, neutral fluid, of a

peculiar odor and burning taste. It is soluble in 8 parts of water, and miscible in all proportions with alcohol, chloroform, benzin, glycerin, and fixed oils.

Dose.—1–2 fluidrachms (4.0–8.0 Cc.).

Chlōral-ammōnium.—Obtained by passing a rapid current of dry Ammonia through a solution of Anhydrous Chloral and Chloroform as long as it is absorbed. Its chemical name is *trichloramidethylic alcohol.* It occurs as small, white acicular crystals, and is soluble in alcohol and slightly soluble in water, although the aqueous solution is unstable.

Dose.—15–30 grains (1.0–2.0 Gm.).

Chlōralose.—Prepared by heating equal quantities of Anhydrous Chloral and dry Glucose; hence the name, *chloral-ose.*

Description and Properties.—It occurs in the form of fine needles, completely volatilizing without decomposition. It has an acrid, nauseous taste, and is soluble in hot water and in alcohol.

Dose.—2–10 grains (0.12–0.6 Gm.).

Hўpnal.—A compound of Chloral and Antipyrine, known as *monochlorantipyrine.* A similar preparation containing more chloral is called *dichloralantipyrine.*

Description and Properties.—It occurs in the form of transparent, rhombic crystals, odorless and tasteless, soluble in from 5 to 6 parts of water.

Dose.—5–20 grains (0.35–1.3 Gm.).

Hўpnone.—A term given by Dujardin-Beaumetz to a member of the ketones, known as *acetophenone* or *phenylmethyl-ketone, phenomethyl-acetone.*

Description and Properties.—A colorless, mobile, refrangent liquid, of a pungent taste and a persistent odor resembling that of bitter almond and orange. It is not inflammable, though intensifying the combustion of substances impregnated with it. It is freely soluble in alcohol, ether, chloroform, benzin, and fixed oils, sparingly soluble in glycerin, and insoluble in water.

Dose.—5–10 minims (0.3–0.6 Cc.).

Unofficial Preparations.—A Syrup and an Elixir of Hypnone are in use.

Ūral—Chlōral-ūrethane—Urālium.—A compound of the following drug, Urethane, and Chloral Hydrate.

Description and Properties.—A crystalline body, soluble in alcohol and ether, insoluble in cold water, and decomposed by boiling water.

Dose.—10–30 grains (0.6–2.0 Gm.).

Ūrethane—Ĕthyl Cărbamate—Ĕthyl Ūrethane.—This substance is obtained by the action of Ammonia on Ethyl Carbonate, or by that of Urea or Carbamide on Ethyl Alcohol at a high temperature.

Description and Properties.—It occurs as colorless, odorless, columnar or tabular crystals, having a pleasant, cooling, and saline taste, somewhat resembling that of saltpetre. It is soluble in about 1 part of water, and in like proportion in ether and chloroform, in 0.6 part of alcohol, 0.8 part of liquefied carbolic acid, 3 parts of glycerin, 15 parts of castor oil, and 20 parts of olive oil.

Dose.—10–45 grains (0.6–3.0 Gm.).

Cănnabin Tannate and **Hўoscine Hydrobromate** are both quite powerful hypnotics, to be described under *Cannabis Indica* and *Hyoscyamus*, respectively.

The action and therapeutics of the above allied compounds will be compared with those of chloral hereafter.

Antagonists and Incompatibles.—Chloral is incompatible with all alkalies, and calcic hydrate converts it into formate of calcium and chloroform.

Liebreich considers strychnine an antagonist to chloral. But from the fact that the principal action of strychnine is upon the reflex centers in the spinal cord, its efficacy in opposing chloral is certainly inferior to that of chloral as an opponent to strychnine. Atropine is undoubtedly a stronger antagonist in counteracting the depressing influence of chloral upon the heart and respiration, as well as upon the spine. External heat is also an opponent.

Synergists.—All the hypnotics favor its characteristic property of producing sleep. Morphine enhances its hypnotic effects, while lessening its depressing influence upon the heart.

Physiological Action.—*Externally and Locally.*—Chloral is antiseptic, anesthetic, and vesicant. It produces redness and sometimes vesication when applied to the unbroken skin, and when strong solutions are brought in contact with the derma or with wounds they may even occasion sloughing, and in healthy mucous membranes excite much pain. When introduced into the system hypodermically chloral is apt to occasion gangrenous inflammation.

Internally.—Digestive System.—Small doses are slightly sedative to the stomach, though causing a sense of burning in the throat and exciting more or less salivation. Large doses sometimes produce nausea, vomiting, and purging.

Circulatory System.—Full medicinal doses may at first accelerate the pulse, which soon, however, becomes slower, weaker, and softer. Under toxic doses the heart's action may be weak, rapid, and irregular, when death ensues, the heart being arrested in diastole.

A primary effect of chloral is to lower arterial tension by its depressant action upon the heart through its nervous mechanism. It acts similarly upon the vaso-motor center and upon the structures in the arteriole wall, dilating the blood-vessels.

The fluidity of the blood is increased by the action of chloral, and under large doses the red corpuscles are crenated and there is a tendency to destroy the white corpuscles.

Nervous System.—Medicinal doses sometimes occasion a preliminary stage of cerebral excitement, due probably to a combined temporary stimulation of the circulation and of the brain-tissue itself. This is soon followed—usually in from fifteen to thirty minutes—by a sound, dreamless slumber, induced by a direct depression of the cortical cells of the psychic areas and an anemic condition of the brain.

The sleep thus produced is perhaps nearer that of physiological slumber than any caused by other agencies, lasting from seven to eight hours, when the patient awakes refreshed and without *malaise* or digestive disturbance.

As upon the circulation and the brain, so upon the nerve-centers, there is usually a preliminary stage of excitement, with exaggerated reflexes. This condition is, however, of short duration, and is succeeded by a greatly diminished reflex irritability of the spinal cord and total abolition of reflexes if toxic doses have been taken. This action upon the spinal cord is due to the depression of its reflex centers, as well as of the sensory centers in the nervous system.

Respiratory System.—In full doses chloral is a respiratory depressant, rendering the breathing slower and weaker, while under toxic doses it may cease altogether from paralysis of the respiratory center. Death may result from this action or from paralysis of the cardiac motor ganglia.

Absorption and Elimination.—Chloral is quite rapidly absorbed, and is supposed to circulate in the blood in its original state. It is eliminated by the lungs and skin, but chiefly by the kidneys, where it reappears as urochloralic acid, which consists of trichlor-ethyl alcohol combined with glycuronic acid, although when an excessive amount of the drug has been taken it may be found in the urine unchanged. It usually increases the flow of urine, which gives a reaction for sugar with Fehling's test.

Temperature.—Chloral is a decided antipyretic even in medicinal doses, while toxic doses produce a dangerous reduction of temperature. This action is doubtless owing to a diminution of heat-production by limiting oxidation in the cells of the body and increasing heat-dissipation by cooling the blood in the dilated cutaneous vessels and by surface evaporation.

Eye.—The continued use of chloral almost invariably results in a contracted pupil, unless psychic alterations supervene, when the pupillary contraction gives place to dilatation. This action of chloral is due to paresis of the sympathetic nerves supplying the iris. Berger claims that when mydriasis is present there is usually a congestion of the papilla, resulting from distention of the retinal veins; while, according to Ulrich, intraocular tension is lessened in the later stages of chloralism.

Untoward Action.—There may occur great anxiety; disturbances of respiration, such as spasmodic breathing and even as-

phyxia, together with disturbances of vision and swelling of the conjunctivæ. There may also be present edema of the epiglottis, icterus, and various cutaneous eruptions commonly designated as "chloral rash."

Poisoning.—Although one of the most powerful hypnotics known, extraordinary doses of chloral have failed to prove fatal, as many as 460 grains (29.8 Gm.) having been given without perceptible discomfort. Nevertheless, 20 grains (1.29 Gm.), an ordinary dose, have been followed by toxic effects, while 30 grains (1.94 Gm.) have produced death. In view of so uncertain a power great care is requisite in the administration of this drug. In many ways its action is occult, nor have careful autopsies of fatal cases furnished insight into the precise causes of collapse, however clearly certain physiological effects may be defined.

The toxicology of chloral may be classed under two general heads—acute and chronic poisoning. In each of these the symptoms are sufficiently marked to indicate a corresponding treatment, although the doubtful action of chloral hydrate has caused it to become the subject of special study and a more careful method of administration than formerly.

Acute Poisoning.—Owing to the peculiar action of chloral, the symptoms of poisoning from lethal doses are those characterizing profound coma. The pulse is feeble, thready, and irregular; the temperature falls rapidly; there is a striking diminution in the frequency of respiration, with accompanying lividity; the skin, particularly that of the forehead and extremities, is covered with cold sweat; the pupil contracts and then dilates perceptibly, and great muscular relaxation occurs, together with abolition of reflexes, until finally the cerebral functions are suspended and death ensues, caused by paralysis of the respiratory center, the arrest of the heart's action taking place in diastole. Autopsies have revealed cerebral and pulmonary congestion, together with enlargement of the right cardiac cavities. Since chloral but slightly affects the motor nerves, and has little influence in impairing muscular contractility, it appears that the paralytic phenomena attending collapse are due chiefly to the direct action of the drug upon the nerve-centers.

Treatment of Poisoning.—It is of primary importance to maintain or restore the temperature by means of artificial heat—warm blankets, hot bottles, friction, massage, or other resources at command. (It has been found that animals are much less susceptible

to chloral-poisoning when their temperatures are sustained by outward appliances than when exposed.)

Somnolence is to be resisted by such resources as flagellation, friction, douches, beating with wet towels, by injection of strong hot coffee in the rectum, or any other means readily available. It must be borne in mind, however, that the toxic effects of chloral, unlike those of opium, tend to reduce cardiac activity, the patient often dying simply from exhaustion; so that violent exercise, such as brisk walking, is to be discouraged as a restorative.

In order to arrest respiratory failure and stimulate the circulation, hypodermic injections of strychnine or atropine or the administration of other physiological antidotes, the inhalation of oxygen, and artificial respiration, may prove advantageous. Galvanism, internal stimulants, digitalis, and carbonate of ammonium have also been tried, with beneficial results.

Chronic Poisoning.—Chloral toxemia, or chloralism, is a well-recognized development of simple dosage, in which the habitual use of the drug becomes as baneful and tyrannical in its operation as the opium-habit or confirmed alcoholism. Various symptoms mark the degrees of excess, in which the respiratory apparatus, the skin, and the entire circulation are severally affected.

Respiration is embarrassed by the presence of dyspnea, which, however slight, is manifested after meals or is stimulated by physical exertion. The skin may be subject to erythematous eruption, either persistent or temporarily excited by trivial causes. Finally, the gravest complications may occur in the circulatory system, resulting in high fever, pyemia, and ultimate collapse.

The line of demarkation between these stages of toxemia cannot be infallibly drawn, the general effects of chloralism being somewhat dependent upon the temperament and habits of the individual. The following symptoms are more or less apparent in all cases of chronic poisoning:

The eyes are brilliant; the speech is voluble, often uncontrollable; and the manner strangely affected by nervous excitement. As the craving for the drug assumes the phase of monomania through habitual indulgence, its votary appears to border upon pronounced insanity. The eyes become irritable and injected, the manner more restless, and the subject is sensible of vacuity in the brain and liable to accesses of vertigo. During the daytime a listless stupor allied to melancholia is observable; the appetite is uncertain, often entirely wanting, and digestion difficult. These symptoms are

accompanied by profound lassitude and debility of heart-action, together with marked anemia, especially of the lower extremities. Meanwhile, the hepatic functions are deranged, the secretion of bile is deficient, and an increasing weakness of the limbs simulates paralysis. The stools are colorless and wanting in biliary elements, and the urine is stained with bile and at times albuminous and saccharine.

At this stage of chloralism the necessity of the drug in order to overcome insomnia has grown to be imperative, sleep being induced only through the agency of the accustomed hypnotic. An over-dose may now at any moment produce death in the manner above indicated, the cumulative effects of the poison with which the system is saturated wholly deranging the vital functions and rendering elimination impossible.

The simplest treatment in these extreme cases is primarily the gradual withdrawal of the toxic agent, although delirium tremens is recorded as a result of abstention. The diet should be carefully regulated with a view to restoring, if possible, the decreased vitality. Change of scene, abundant air and exercise, chalybeate tonics, calmatives, and nerve-stimulants undoubtedly contribute to re-establish functional activity and normal circulation, and occasional purgatives may assist in eliminating from the system the noxious elements with which it has become chronically affected.

The following prescription has been suggested as efficacious in cases of established chloralism:

℞. Chloralis,		ʒij vel iv;
Morphinæ sulphatis,		gr. ij;
Syr. lactucarii (Aubergier),		f ʒij;
Aquæ,	q. s. ad	f ʒiij.

Sig.—Dessertspoonful in water at 10 and 11 P. M., if necessary.

Therapeutics.—*Externally and Locally.*—An injection into the sac of a 10 per cent. solution of CHLORAL has been highly recommended by Marc Sée in the treatment of *hydrocele.* One ounce of this solution is injected, being followed in two or three days by a copious effusion, which is soon absorbed.

The antiseptic properties of chloral are utilized as a wash or dressing in *cancer of the uterus, foul ulcers,* etc. For these purposes the strength should be from 5 to 10 grains (0.3 to 0.6 Gm.) to 1 ounce (30.0 Cc.). *Gonorrhea* is readily cured in many instances by a 1 per cent. injection of this drug.

Spohn recommends the continued application of a solution of 1

drachm (4.0 Gm.) of chloral in 4 drachms (16.0 Cc.), each, of glycerin and water in cases of *furuncle*.

Bromidrosis and *hyperidrosis* have yielded to local applications of from 2 to 5 per cent. aqueous solutions of chloral.

Sir Morrell Mackenzie successfully employed a pigment composed of 25 grains (1.6 Gm.) of this drug to 1 drachm (4.0 Cc.) of syrup, as a local application to the throat in *diphtheria*.

CAMPHORATED CHLORAL is often an efficient remedy for *toothache*, and, when mixed with petrolatum or simple ointment in the proportion of 1 to 7, makes an excellent application in *pruritus* and other itching diseases where the skin is unbroken. This preparation undiluted has been used in *neuralgia*, painted over the affected nerves.

Crégny employs a 20 per cent. solution of CHLORAL in *anal fissure*, and a 1 per cent. solution is used in *cracked nipples*.

Chloral is frequently used to preserve urine for microscopic examination, though it should not be added to urine reserved for chemical analysis intended to detect the supposed presence of sugar.

Solutions of chloral are used for embalming purposes and the preservation of anatomical specimens.

Internally.—The principal use of CHLORAL internally is to depress the psychic mechanism and produce sleep. It is also employed to depress the reflexes and motor apparatus, and thereby diminish convulsions, and is sometimes useful in lowering the action of the sensory mechanism.

As a hypnotic it is especially valuable in conditions characterized by excessive cerebral activity, such as *insomnia* resulting from overwork or worry, and in the wakefulness of many acute diseases —*typhoid*, *typhus*, and other *fevers*, *delirium tremens*, and *puerperal mania*—it is a remedy of well-known efficacy. Its depressing effects should always be guarded against during the active course of disease, as well as in delirium tremens where great cardiac weakness already exists. The insomnia of convalescence would usually indicate its use. Indeed, where no special contraindication to its employment exists it is the most satisfactory hypnotic we possess.

On account of its powerful depression upon the motor mechanism it is a valuable drug in treating the various *convulsions* and *spasmodic disorders of childhood*, such as *chorea*, *whooping cough*, *laryngismus stridulus*, and all *infantile convulsions* and *colic*.

Even in *asthma*, *tetanus*, *uremic convulsions*, *hiccough*, and *strychnine-poisoning* chloral has proved an important remedy.

Certain forms of *epilepsy*, particularly the nocturnal variety, are benefited by this drug, and it has been found useful in *angina pectoris*, though it should be very cautiously administered in these cases if there be reason to suspect valvular disease or degeneration of the cardiac muscle.

The reflex *vomiting* in *pregnancy* is sometimes relieved by either the internal administration of chloral or by enemas. It has also been used to depress the reflexes in *sea-sickness*.

Cholera and *cholera morbus* are often alleviated by the hypodermic injection of this drug, in 10- or 15-grain (0.6–1.0 Gm.) doses.

Spasmodic rigidity of the os uteri is greatly reduced by a medicinal dose of this remedy, and, while its action on the sensory mechanism is feeble, it is nevertheless frequently efficient in modifying the *pains of labor* and in quieting the alarm and allaying the nervous excitement of the mother.

There are certain other pains of moderate intensity, especially those of *neuralgia*, which are temporarily more or less relieved by chloral. Its anodyne effect, however, is too transient to render chloral very popular as an analgesic.

A combination of morphine and chloral is a very efficient anodyne and hypnotic in sleeplessness due to pain, which is palliated by this combination with less digestive disturbance than if the former drug had been used alone, and less cardiac depression than if the latter had been the sole remedy, the medicines thus aiding each other and serving the twofold purpose of mitigating pain and inducing sleep.

The author desires to recommend here chloral hydrate as an antipyretic. As has been previously stated, the hypnotics possess many of the characteristics of antipyretics, antiseptics, and anesthetics.

Chloral possesses to a considerable degree the properties of a typical antipyretic. It is antiseptic, somewhat volatile, and readily eliminated, and thought by some observers to be changed in the system into chloroform and sodium formate, while, if not pushed too far, it is not toxic.

We know that one of the principal actions of chloral is to reduce temperature; indeed, toxic doses may exert so marked an effect as to produce death by loss of heat alone.

In *sthenic fevers* chloral is an admirable remedy, not only as an antipyretic, but in allaying nervous irritability, restlessness, and excessive cardiac action, and, in the opinion of the author, this remedy claims far more attention in these cases than it has received.

Contraindications.—Fatty heart; marked respiratory weakness, whether due to acute or chronic disease of the lungs; atheromatous degeneration of the blood-vessels. Owing to the lessened alkalinity of the blood, the action of chloral is so unfavorable in acute inflammatory rheumatism as to justify classing this disease under the present head.

The drug should be administered cautiously, the patient being uninformed as to its nature in certain nervous diseases, lest he acquire the chloral habit.

Administration.—As is recommended in the case of all drugs, only the purest article should be prescribed. Frequently the untoward symptoms of chloral are due more to the impure article than to any idiosyncrasy against it. The recrystallized form alone should be used, the first dose administered not exceeding from 15 to 20 grains (1.0 to 1.2 Gm.), repeated as occasion may demand. Ordinarily, a maximum dose should not be given oftener than once in forty-eight hours.

Children bear chloral well, and, as a rule, 1 grain (0.06 Gm.) may be prescribed for each year of the child's age.

Enemas of chloral may be rendered less irritating by mixing the drug with the yolk of an egg and milk. Chloral should always be well diluted when given internally, especially when combined with sodium or potassium bromide. Its disagreeable taste may be partially disguised by mixing the solution with peppermint water and elixir or syrup of orange.

The following differences exist between the action and therapeutics of chloral and those of the various allied compounds mentioned above:

Ămylene Hȳdrate is considered by many observers to be safer than chloral, while its soporific effects are produced sooner, being manifested usually in from five to thirty minutes, the awakening being ordinarily prompt and complete. In toxic doses it paralyzes the respiratory and cardiac centers.

Its comparison with chloral is so well stated by Laves that his remarks are here quoted *verbatim*. "It has," he says, "neither the unpleasant and persistent taste and smell of the latter (chloral), nor the same uncertainty of action. It seems to have about half the strength of chloral, and, although its hypnotic action is perhaps less certain, the sleep it causes is more refreshing and the mind remains clearer after its use."

Amylene hydrate is best given in a mixture of wine and syrup of liquorice; if administered by the rectum, it should be suspended in mucilage.

Chlōr-ammōnium is not so depressing upon the heart and circulation, yet it does not offer sufficient advantages over chloral to justify its use as a substitute.

Chlōralose.—Its taste is to many persons more nauseating than that of chloral, while its action is practically identical, though perhaps not so depressing upon the spinal cord, its influence being exerted rather upon the brain. It probably also possesses more anodyne properties, and would therefore be superior to chloral as a hypnotic in insomnia with pain, sleep being produced in about half an hour.

Chloralose is best administered in capsules followed by a drink of water, to prevent too great irritation of the mucous membranes of the stomach.

Hȳpnal.—This substance possesses more antispasmodic properties than chloral, and theoretically it should be a better analgesic, it being a compound of chloral and antipyrine. Yet physicians who have had the largest experience with the drug claim its effects to be illusory, and that it has no special value as an anodyne. Indeed, Dujardin-Beaumetz, who introduced the drug, regarded it more of a soporific than anodyne.

Hypnal causes greater gastric disturbance than chloral, and, withal, cannot be recommended as an efficient substitute for it.

It may be dissolved in almond oil and given in capsules, or administered in a mixture of wine and cordial or some aromatic syrup.

Hȳpnone.—As a hypnotic a much weaker substance than chloral, although it has found some advocates as a remedy for the insomnia of alcoholism. Toxic doses paralyze the heart and respiration. It should be given in capsules.

Urăl—Chlōral-ūrethane.—A good hypnotic, yet possessing no special advantages. It is not so depressing upon the circulation, but is a more feeble antipyretic than chloral.

Ūrethane.—Its physiological action is almost identical with that of chloral. It is less depressing upon the circulation and respiration, but more so upon the peripheral ends of the motor nerves. Acting directly upon the cerebrum, it produces a refreshing and dreamless sleep, with no unpleasant after-effects. Nevertheless, it is not so reliable a hypnotic as chloral, and its usefulness as a therapeutic agent is still a debatable question, probably no hypnotic having been introduced concerning the effects of which there is such diversity of opinion. Until, therefore, its use shall be restricted to a place universally assigned to it, there can be no good reason why urethane should supplant chloral for any purpose.

It may be given in capsules or in some pleasant water or syrup, and may also be conveniently administered as an injection by the rectum.

Chlōral Formamidātum—Chlorālis Formamidāti—Chloral Formamide.

(CHLORALAMIDE.)

Origin.—Obtained as the result of the interaction between Anhydrous Chloral and Formamide, consisting of Chloral Anhydride 2 parts and Formamide 1 part.

Description and Properties.—Chloralamide occurs as white, shining, odorless crystals, having a faintly bitter taste. It is soluble in 9 parts of water and in 1½ parts of alcohol.

Dose.—10–30 grains (0.65–2.0 Gm.).

Antagonists and Incompatibles.—It is decomposed into chloral with alkalies and with water at above 140° F.

Synergists.—The bromides of sodium and potassium.

Physiological Action.—As might be expected, when the stimulating action of ammonia is combined with the soporific action of chloral, as is the case in chloralamide, we have a substance much less depressant upon the heart and respiration than chloral, although probably possessing as active hypnotic properties. Its action upon different systems compared with that of chloral is as follows:

Externally and Locally.—It is not so irritating to mucous membranes as chloral.

Internally.—Digestive System.—In its action it does not differ essentially from chloral.

Circulatory System.—Its influence is very feeble, producing no perceptible effect upon the pulse in medicinal doses.

Nervous System.—It probably acts as powerfully upon the cerebral cortex as chloral, but in medicinal doses does not depress the spinal cord to the same extent, though toxic doses may abolish the reflexes and the conductivity of the motor nerves. It produces, usually in from thirty minutes to one hour after its ingestion, a sleep which lasts from six to ten hours, with no bad after-effects. As an analgesic it is superior to chloral.

Respiratory System.—It is an active respiratory stimulant in medicinal doses, through its influence upon the center. Toxic doses, on the other hand, paralyze the respiratory center.

Absorption and Elimination.—In the blood it is converted into chloral and formamide, being chiefly eliminated with the urine, which it tends to diminish—as well as the amount of phosphates excreted—though it is said that the urea is increased by small and lessened by large doses.

Temperature.—In medicinal doses the temperature is uninfluenced.

Untoward Action.—Restlessness, mild delirium, rapid and feeble heart, great thirst, nausea, and vomiting.

Poisoning.—Its toxic effects are similar to those of acute chloral-poisoning. It does not possess the cumulative action of the latter drug nor any tendency to induce chloralism.

Treatment of Poisoning.—The same as for acute chloral-poisoning.

Therapeutics.—It is not employed externally and locally. Its therapeutic uses are similar to those of chloral. As a hypnotic it is superior when there is cardiac or respiratory weakness. In the *insomnia of neurasthenia* it is especially valuable, and, in conjunction

with potassium bromide, is preferable to a like combination with chloral in cases of *sea-sickness.*

By many physicians it is thought to relieve pain better than chloral, which, if true, would render it superior in *insomnia complicated with pain.*

Administration.—It is best given in aromatic elixir or some other dilute alcoholic vehicle. Simple syrup slightly acidulated with hydrochloric acid, beer, and sweet wine are also recommended as pleasant menstrua. When given at night for insomnia the medicine should be taken upon an empty stomach, about one hour before sleeping-time.

Chlōral Butȳlicum—Chlorālis Butȳlici—Butyl-chloral Hydrate.

(CROTON-CHLORAL.)

Origin.—Prepared by passing dry Chlorine Gas into Acetic Aldehyde, resulting in the formation of butyl-chloral, which is separated by fractional distillation, and Water added.

Description and Properties.—Butyl-chloral occurs as a heavy, colorless oil, having an odor resembling that of chloral. The hydrate (croton-chloral hydrate) used in medicine is in the form of white scales, of a silky luster, nauseous taste, and a peculiar fruit-like odor. It is freely soluble in alcohol, ether, glycerin, and hot water, but not easily soluble in cold water. Its solutions are unstable, and are decomposed if kept on hand even for a short time.

Dose.—3–20 grains (0.18–1.2 Gm.).

Incompatibles and **Synergists** are the same as for chloral.

Its **Physiological Action** and **Therapeutics** are quite similar to those of chloral, though it is considered less depressing to the heart and circulation, while possessing greater anodyne properties, having a selective action upon the fifth nerve, doses even of 2 grains (0.12 Gm.) often producing anesthesia of the trigeminal nerve before other actions of the drug are manifest.

It is therefore superior to chloral as an anodyne and hypnotic in *headaches, facial neuralgia, tic douloureux, migraine,* etc.

As a simple hypnotic it is feebler and more uncertain in its effects than chloral, and, even with its alleged advantages, it is doubtful if it will ever supplant that drug to any extent, save in cases of *neuralgia of the fifth nerve* and *painful spasm of the face.*

In facial neuralgias a mixture of butyl-chloral and tincture of camphor may be applied locally.

Contraindications.—Hyperemia of the brain, gastro-intestinal irritation, and weak heart.

Administration.—It should be given in pill form or in capsules. If given in solution, the bitter taste may be disguised by dissolving it in the aromatic elixir or syrup of liquorice. A mixture of glycerin, syrup, and peppermint water also serves as a good vehicle.

Sŭlphonal—Sŭlphonal—Sulphonal.

The chemical name of this drug is *diethyl-sulphon-dimethyl-methane.*

Origin.—It is prepared by combining Ethyl Hydrosulphide (Mercaptan) with Acetone, forming mercaptol, which is oxidized by potassium permanganate into sulphonal.

Description and Properties.—It occurs as colorless, odorless, nearly tasteless prismatic crystals; soluble in 450 parts of cold water, in 15 parts of boiling water, and in 65 parts of cold or 2 parts of boiling alcohol. It is a very stable substance, being unaffected by concentrated acids or alkalies.

Dose.—15–30 grains (1.0–2.0 Gm.).

Allied Compounds.

Trĭonal (Diethyl-sulphon-methyl-ethyl-methane).—*Origin.*—Prepared exactly like sulphonal, except that Methyl-ethyl-ketone is used in place of Acetone.

Description and Properties.—Shining, colorless, odorless, crystalline plates; freely soluble in alcohol, and soluble in 320 parts of water. It is more rapid in its action than sulphonal, and comparatively safe.

Dose.—10–40 grains (0.6–2.5 Gm.).

Tĕtronal (Diethyl-sulphon-diethyl-methane).—*Origin.*—This substance is also prepared like sulphonal, differing from the latter in that it contains two additional ethyl groups, and, being more poisonous, is consequently more unsafe as a remedy.

Description and Properties.—Colorless, shining plates and laminæ, of bitter taste and slightly camphoraceous odor; soluble in 450 parts of cold and in 5 parts of boiling alcohol; insoluble in water.

Dose.—10–40 grains (0.6–2.5 Gm.).

Antagonists and Incompatibles.—There are none of importance, and, owing to its insolubility, sulphonal is usually given alone.

Synergists.—Morphine intensifies its hypnotic action.

Physiological Action.—*Externally and Locally,* sulphonal has no influence.

Internally.—Digestive System.—In medicinal doses it has no

effect on the digestive tract. Toxic doses may result in nausea, vomiting, and gastric pain.

Circulatory System.—It has no depressing action on the heart; on the contrary, it is stated by Shick to accelerate the pulse and slightly raise arterial tension.

Nervous System.—Like chloral, it depresses the cerebral cortex, but has no influence upon the motor or sensory nerves. Shick believes that it stimulates Setschenow's reflex inhibitory centers, and to this influence is due the diminished reflex activity occasioned by the drug.

It is capable of producing sleep, but its action is very much slower than that of chloral, from three to eight hours often elapsing between the ingestion of a medicinal dose and its soporific effect, the duration of which averages about seven hours. The mental disturbance which ensues is greater than in the case of chloral. Sulphonal possesses no anodyne properties.

Respiratory System.—In medicinal doses it is much less depressing to the respiratory center than chloral, yet when death from sulphonal occurs it is usually the result of respiratory paralysis.

Absorption and Elimination.—Kast alleges that it is slowly soluble in the gastric juice and gradually absorbed. William J. Smith of London, who has experimented extensively with this drug, claims that it is eliminated by the kidneys as ethyl-sulphonic acid. It has also been shown that under the administration of large doses or prolonged use a small quantity of sulphonal is eliminated as such unchanged. Furst states that the greater portion is excreted in the form of soluble sulphates, and that the urine often contains traces of albumin and renal elements, wisely suggesting that the drug be at once discontinued should there be reason to suspect the presence of hematoporphyrin, as indicated by the discoloration of the urine.

Temperature is unaffected by medicinal doses.

Eye.—Knaggs and Dillingham report cases accompanied by affection of the eye, loss of sensation in the conjunctivæ, and ptosis lasting two weeks. The cause in these instances was sulphonal-poisoning. Medicinal doses produce no notable effect upon this organ.

The *Untoward Action* and *Poisoning* resulting from the use of sulphonal present symptoms of so varied a character that the drug seems to possess no properties of a uniformly toxic nature. Moreover, in the cases of poisoning recorded the condition of the patient

and the quality of the drug have been such as to require considerable variation in the amount given. In one case 30 grains (2.0 Gm.) produced death in forty hours (*Med. News*, lv. p. 166), while in another a man swallowed 3 ounces (96.0 Gm.) of sulphonal, which, although resulting in a condition of coma lasting six days, terminated in recovery (*Journ. Amer. Med. Assn.*, iv. p. 21).

Perhaps the most prominent symptoms of acute sulphonal-poisoning are painful convulsions, vomiting, constipation or diarrhea, hematoporphyrinuria, and diminished urine, containing bile, blood, and epithelial casts. "Sulphonalism," or chronic poisoning, produces vertigo, headache, somnolence, mental and muscular debility, edema of the eyelids, cyanosis, and many other deranged conditions of the system.

Treatment of Poisoning.—Discontinuance of the drug; eliminative and symptomatic treatment.

Therapeutics.—Sulphonal is never used *externally*, and *internally* it is valuable only as a hypnotic—in insomnia unaccompanied by pain, and particularly to produce sleep and quiet the intense *excitement of the insane.* In the author's opinion, its many disadvantages, together with its unreliability and uncertainty of action, should relegate it to a place greatly inferior to that of chloral or any other hypnotic mentioned above. No skilled and conservative physician can peruse the literature of sulphonal without being startled by the incongruous statements contained therein, being tempted to attribute the irrational statements concerning not only this drug, but other new synthetical remedies, to the ill-advised efforts of some sensational physicians, alike inexact and illogical, to advertise themselves rather than give expression to established, incontrovertible facts.

Contraindications.—None of importance.

Administration.—Sulphonal should be given in powder or capsules or in hot whiskey. Owing to its insolubility, it should not be administered in the form of compressed tablets.

Paraldehȳdum—Paraldehȳdi—Paraldehyde.
U. S. P.

Origin.—A polymeric form of Ethylic Aldehyde.

Description and Properties.—A colorless, transparent liquid, having a strong, characteristic, but not unpleasant, pungent odor, somewhat resembling that of chloroform, and a burning, cooling taste. Soluble in 8.5 parts of water and in 16.5 parts of hot water, being, as will be observed, more soluble in the former than in the

latter. Miscible in all proportions with alcohol, ether, and fixed and volatile oils.

Dose.—¼–1 fluidrachm (1.0–4.0 Cc.).

Unofficial Preparation.

Ellĭxir Paraldehȳdi—Ellĭxir Paraldehȳdi—Elixir of Paraldehyde.—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Synergists.—Opium and the hypnotics aid its action.

Physiological Action.—*Externally and Locally.*—Antiseptic, antifermentative.

Internally.—Digestive System.—Paraldehyde has no action upon the digestive tract.

Circulatory System.—It differs from chloral in affecting the circulatory system favorably in medicinal doses, tending rather to slow and strengthen the pulse. Toxic doses weaken the heart and lower arterial pressure, the heart's action ceasing in diastole.

Nervous System.—Its influence upon the brain and spinal cord is similar to that of chloral. The sleep it induces, however, is not so prolonged as that caused by the latter drug, more frequent doses being required for continued soporific effects. The sequelæ of paraldehyde are not unpleasant.

Respiratory System.—Its action resembles that of chloral, although it is not so powerful a respiratory depressant. In toxic doses death usually ensues from paralysis of the respiratory center.

Absorption and Elimination.—Paraldehyde is eliminated by the lungs and kidneys.

Temperature.—Like chloral, it lowers the temperature, but in less degree.

Untoward Action.—It occasionally causes irritation of the mucous membranes and erythematous eruption.

Poisoning.—The symptoms of poisoning are similar to those of chloral. Fatty degeneration of the heart and liver have been found, together with disorganization of the red corpuscles.

Treatment of Poisoning.—The same as in poisoning from chloral.

Therapeutics.—Like those of chloral. Paraldehyde is more hypnotic than anodyne, appearing to be best adapted to relieve so-called *idiopathic insomnia*. It is a better diuretic than chloral, and in certain degenerated conditions of the heart and arteries, where a diuretic as well as hypnotic is desirable, paraldehyde serves as a valuable remedy.

Cervello has recommended it highly in *strychnine-poisoning*, and several cases of its successful use in *tetanus* are reported.

Administration.—It may be given in capsules, or, when otherwise administered, its unpleasant taste may be disguised by giving it in an emulsion flavored with orange or bitter almond. Glycerin also renders it quite palatable, yet it is always more disagreeable to the taste than chloral, besides lending to the breath an offensive and persistent odor.

GROUP V.—NARCOTICS.

Ōpium—Ōpii—Opium. *U. S. P.*

Origin.—The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* (L.), the substance in its normal moist condition yielding not less than 9 per cent. of crystallized morphine when assayed.

The poppy from which opium is derived is indigenous in Western Asia and cultivated in Egypt, Persia, Asia Minor, the elevated plains of India, and in some parts of Europe.

Description and Properties.—Opium appears in irregular or subglobular cakes—with the remnants of poppy-leaves and the fruit of a species of Rumex adhering to their surfaces—plastic or of a harder consistence, chestnut-brown or darker, and somewhat shining internally, showing tears, and fragments of vegetable tissue. It has a sharp, narcotic odor and a peculiar, bitter taste. This description applies to the Smyrna, Levant, Turkey, and Constantinople opium. There are, however, five other varieties—viz. 1. Egyptian, flattened, roundish cakes; 2. Persian, black, cylindrical sticks, or small cakes or balls, wrapped in paper; 3. Indian, flat squares covered with mica and wax or an oiled paper wrapper; 4. Chinese, oblate-spheroidal masses wrapped in white paper; 5. European.

Opium contains about twenty different alkaloids, either in a free state or in combination with some acids. The principal alkaloids, in the order of their medical importance, are *morphine*, *codeine*, *narceine*, and *thebaine;* others are *narcotine*, *papaverine*, *cryptopine*, *pseudomorphine*, *protopine*, *hydrocotarnine*, *laudanine*, *cadamine*, *rheadine*, *meconidine*, *laudanosine*, *lanthopine*, *gnoscopine*, and *oxynarcotine*.

The following constituents of opium are in some respects important: *Meconic acid*, *meconin*, *meconoiosin*, and *porphyroxin*.

In addition to the above, opium contains these substances, making it one of the most complex drugs in Materia Medica: *Mucilage, resin, fats, essential oil, glucose, caoutchouc, ammonium, calcium,* and *magnesium salts,* and *odorous* and *coloring matters,* besides certain impurities and adulterants, such as stones, fruits, leaves, starch, water, lead, etc.

Dose.—$\frac{1}{4}$–2 grains (0.015–0.12 Gm.).

Official Preparations.

Ōpii Pŭlvis—Ōpii Pŭlveris—Powdered Opium.—*Dose,* $\frac{1}{4}$–2 grains (0.015–0.12 Gm.).

Powdered opium should yield not less than 13 nor more than 15 per cent. of crystallized morphine.

Acētum Ōpii (10 per cent.)—**Acēti Ōpii—Vinegar of Opium.**—*Dose,* 3–15 minims (0.18–1.0 Cc.).

Extrăctum Ōpii (18 per cent. of morphine)—**Extrăcti Ōpii—Extract of Opium.**—*Dose,* $\frac{1}{8}$–1 grain (0.01–0.06 Gm.).

Emplăstrum Ōpii (6 per cent. of extract of opium)—**Emplăstrum** (acc.) **Ōpii—Opium Plaster.**—For external use.

Formula: Extract of Opium, 60; Burgundy Pitch, 180; Lead Plaster, 780; Water, 80.

Ōpium Deodorātum (13 to 15 per cent. of morphine)—**Ōpii Deodorāti—Deodorized Opium** (Denarcotized Opium).—*Dose,* $\frac{1}{4}$–2 grains (0.015–0.12 Gm.).

Pĭlulæ Ōpii (1 grain, or 0.06 Gm., in each pill)—**Pĭlulas** (acc.) **Ōpii—Pills of Opium.**—*Dose,* 1 or 2 pills.

Pŭlvis Ipecacuănhæ et Ōpii—Pŭlveris Ipecacuănhæ et Ōpii—Powder of Ipecac and Opium (Dover's Powder).—*Dose,* 5–10 grains (0.3–0.6 Gm.).

Formula: 1 grain (0.06 Gm.) Opium, 1 grain (0.06 Gm.) Ipecac, 8 grains (0.5 Gm.) Sugar of Milk, in every 10 grains (0.6 Gm.).

Tinctūra Ōpii (10 per cent.)—**Tinctūræ Ōpii—Tincture of Opium** (Laudanum).—*Dose,* 5–15 minims (0.3–1.0 Cc.).

13 minims (0.78 Cc.) represent about 1 grain (0.06 Gm.) of Opium.

Tinctūra Ōpii Camphorāta—Tinctūræ Ōpii Camphorātæ—Camphorated Tincture of Opium (Paregoric).—*Dose,* $\frac{1}{2}$–4 fluidrachms (2.0–15.0 Cc.).

Formula: Powdered Opium, 4; Benzoic Acid, 4; Camphor, 4; Oil of Anise, 4; Glycerin, 40; Diluted Alcohol, to 1000. Prepared by maceration and percolation. 4 fluidrachms (15.0 Cc.) represent about 1 grain (0.06 Gm.). of Opium.

Tinctūra Ōpii Deodorāti (10 per cent.)—**Tinctūræ Ōpii Deodorāti—Tincture of Deodorized Opium.**—*Dose,* 5–15 minims (0.3–1.0 Cc.).

Tinctūra Ipecacuănhæ et Ōpii—Tinctūræ Ipecacuănhæ et Ōpii—Tincture of Ipecac and Opium (Tincture of Dover's Powder).—*Dose,* 5–15 minims (0.3–1.0 Cc.).

10 minims (0.6 Cc.) contain 1 grain (0.06 Gm.) each of Opium and Ipecac.

Trochĭsci Glycyrrhīzæ et Ōpii—Trochĭscos (acc.) **Glycyrrhīzæ et Ōpii—Troches of Liquorice and Opium.**—*Dose,* 1 to 3 troches.

Each troche contains about $\frac{1}{12}$ grain (0.005 Gm.) of Opium.

Vīnum Ōpii (10 per cent.)—**Vīni Ōpii—Wine of Opium.**—*Dose,* 5–15 minims (0.3–1.0 Cc.).

The *Description and Properties* of the official alkaloids of opium and their salts are as follows:

Morphīna—Morphīnæ—Morphine.—Colorless or white, shining, prismatic crystals, or fine needles, or a crystalline powder, odorless, having a bitter taste, permanent in the air. Soluble in 4350 parts of water, in 300 parts of alcohol, in 455 parts of boiling water, and in 36 parts of boiling alcohol. *Dose*, ⅛–¼ grain (0.008–0.015 Gm.).

Morphīnæ Acētas—Morphīnæ Acetātis—Morphine Acetate.—A white or faintly yellowish-white, crystalline or amorphous powder, having a faint, acetous odor and a bitter taste. Soluble in 2.5 parts of water and in 47.6 parts of alcohol. On protracted exposure to the air the salt gradually loses some acetic acid, becoming less soluble. It should be kept in dark amber-colored, well-stoppered bottles. *Dose*, ⅛–¼ grain (0.008–0.015 Gm.).

Morphīnæ Hydrochlōras—Morphīnæ Hydrochlorātis—Morphine Hydrochlorate.—White, feathery needles, of a silky luster, or minute, colorless, cubical crystals, odorless, having a bitter taste, permanent in the air. Soluble in 24 parts of water and in 62 parts of alcohol. *Dose*, ⅛–¼ grain (0.008–0.015 Gm.).

Morphīnæ Sŭlphas—Morphīnæ Sulphātis—Morphine Sulphate.—White, feathery, acicular crystals, of a silky luster, odorless, of a bitter taste, permanent in air. Soluble in 21 parts of water and in 702 parts of alcohol. *Dose*, ⅛–¼ grain (0.008–0.015 Gm.).

Codeīna—Codeīnæ—Codeine.—White or nearly translucent, orthorhombic prisms, or octahedral crystals, odorless, having a faintly bitter taste, and slightly efflorescent in warm air. Soluble in 80 parts of water and in 3 parts of alcohol. *Dose*, ½–2 grains (0.03–0.12 Gm.).

Various salts of codeine are in use, the sulphate being the most important.

Official Preparations of Morphine Sulphate.

Pŭlvis Morphīnæ Compŏsitus—Pŭlveris Morphīnæ Compŏsiti—Compound Powder of Morphine (TULLY'S POWDER).—*Dose*, 5–15 grains (0.3–1.0 Gm.).

Formula: Morphine Sulphate, 1; Camphor, 19; Glycyrrhiza, 20; Precipitated Calcium Carbonate, 20; Alcohol, q. s. to 60.

Trochĭsci Morphīnæ et Ipecacuănhæ—Trochĭscos (acc.) **Morphīnæ et Ipecacuănhæ—Troches of Morphine and Ipecac.**—*Dose*, 1 to 5 troches.

Formula: Morphine Sulphate, 0.16; Ipecac, 0.50; Sugar, 65; Oil of Gaultheria, 0.2; Mucilage of Tragacanth, a sufficient quantity to make 100 troches. Each troche contains about $\frac{1}{40}$ grain (0.0015 Gm.).

Antagonists and Incompatibles of Opium and its Alkaloids.—The physiological antagonists are atropine, strychnine, coffee or caffeine. Quinine antagonizes some of the cerebral effects of the drug, while tartrate of antimony and potassa (tartar emetic) and digitalis oppose its action on the intracranial circulation. The incompatibles are alkalies, tannic acid and infusions containing it, and salts of lead, iron, copper, mercury, and zinc.

The following are incompatible with morphine and its salts: iodine and iodides, bromine and bromides, Fowler's solution, and sodium borate.

Synergists.—The hypnotic action of opium is aided by the hypnotics; its anodyne influence is enhanced by belladonna and cocaine, and its sudoriferous effects by ipecacuanha.

The **Physiological Action** of opium differs in some respects from that of morphine or codeine, and will therefore be described first.

Externally and Locally.—Applied to the unbroken skin, opium possesses feeble analgesic properties, and from mucous membranes or raw surfaces it is readily absorbed, producing marked anodyne effects.

Internally.—Digestive System.—Its prominent action is upon the secretions—checking that from the salivary glands, causing great dryness of the mouth and consequent thirst—largely diminishing those from the stomach, and reducing the bile and pancreatic juice secreted. In fact, every secretion in the body is lessened except the perspiration, the cause being the depressing influence of the drug upon the secretory centers in the medulla. It may be added that the peristaltic movements of the digestive apparatus are reduced, which, together with diminished secretions, impairs digestion and produces constipation.

The action upon the intestines, however, varies with the dose administered, moderate or full medicinal doses checking peristalsis and promoting constipation. On the other hand, very large or very small doses increase peristalsis, the former augmenting this effect, and producing violent movement of the bowels through the drug's paralyzing action upon the splanchnic inhibitory fibers of the intestine, so that inhibition is removed and peristalsis reinforced. Very small doses act as purgatives when by some reflex disturbance, such as a tender ovary, the peristalsis is inhibited. Minute quantities, by partially benumbing the inhibitory nerves or diverting the stimulus from them to the stimulating fibers, relieve constipation. This action is rendered serviceable in the similar constipation accompanying lead-poisoning, the metal constipating the patient not only by its astringent action, but also by the tetanic spasm of the intestines caused by the irritating action of the lead upon their mucous membrane. The feces are held by spasmodic intestinal contraction, relief of which by a small dose of opium, sufficient to induce peristalsis, will be followed by evacuation.

Circulatory System.—Small doses accelerate the pulse, rendering it fuller and firmer, and dilate the arterioles, though increasing arterial tension. This action is due to stimulation of the vaso-

motor mechanism of the circulatory apparatus. Large doses, while primarily quickening, soon retard the heart's action, rendering the pulse full. This influence is occasioned by stimulation of both ends of the vagus. Should the dose be lethal, the pulse may become rapid and weak from over-stimulation, and consequent exhaustion, of the vaso-motor center and pneumogastric nerves.

Nervous System.—Opium seems to act differently upon the brain and the spinal cord. Upon the former it produces a temporary period of excitement, varying in duration according to the size of the dose administered, small doses greatly stimulating the imaginative faculty. The state of excitation is followed by depression, soon yielding to easily disturbed sleep, frequently disturbed by dreams, which may be of a pleasant, voluptuous character or disagreeable and hideous, the condition of the patient at this time varying with the dose he has taken—all occasioned by removal of the inhibition from the reflex centers. If it has been sufficient to produce profound stupor, the patient is insensible to sound, light, or external irritation. Pain is abolished, and the reflexes transmit no impression. On waking the patient complains of headache, a feeling of languor, vertigo, nausea, and constipation.

Opium first stimulates and afterward depresses the higher centers, the same action being subsequently manifested in the lower centers.

The cerebral exhilaration is doubtless the result of an increased blood-supply to the brain, while the sleep and mental depression are due to the direct sedative action of the drug upon the cortical cells of the brain.

Pain is relieved by opium through its depressing influence upon the entire sensory apparatus, the peripheral ends of the sensory nerves, the conducting path in the spinal cord, and the receiving cerebral center all being similarly affected by opium, rendering the drug one of the most powerful analgesics known.

Respiratory System.—In very small doses opium slightly stimulates respiration; in full or large doses it is a strong respiratory depressant, its action being upon the center in the medulla. Death is usually caused by paralysis of respiration.

Absorption and Elimination.—Opium is rapidly absorbed, and is eliminated chiefly by the gastro-intestinal mucous membrane and very little by the kidneys.

Moderate quantities of the drug are oxidized in the body, though when large doses are administered opium may be found

unchanged in the urine. It is also excreted in the bile, in the milk, and to some extent in the sweat, which is largely increased by opium, particularly when the drug is combined with ipecacuanha, as in Dover's powder. The sweat is the only secretion augmented by opium, although the manner in which the sudoriparous glands are stimulated is not positively known—whether centrally or peripherally. Probably the action is due to increasing venosity of the blood stimulating the sweat-centers in the spinal cord.

The reabsorption of opium may be prevented by frequently washing out the stomach, from which viscus the drug is mainly eliminated. Catheterization is also indicated from time to time to assist elimination.

Temperature is at first raised, but later lowered when free diaphoresis is established.

Eye.—The pupils are minutely contracted by large doses, the *modus operandi* not being fully understood, though probably the action is due to stimulation of the oculo-motor center. The pupil usually dilates just before death from opium-poisoning, owing either to paralysis of the oculo-motor center or depression of the sympathetic fibers, and, perhaps, excessive venosity of the blood.

Untoward Action.—Headache, disturbances of hearing, muscular tremor or temporary paralysis, itching of the skin with or without eruption. In case the latter symptom appears, it is commonly in the form of small red spots resembling roseola. An erythematous inflammation may affect the mucous membrane of the mouth and throat.

Morphine has produced paresthesia of the sense of taste, as well as spasm of accommodation of the eye and edema of the eyelids. Many other untoward manifestations occur, even under minute doses, in persons having an idiosyncrasy against the drug.

Poisoning.—Small medicinal doses of opium, as we know, tend to produce moderate excitement, a pleasing sense of freedom from care, and, in sleep, tranquil, even happy, dreams. Far otherwise it is with *toxic doses.* Under their influence the entire physiological conditions of the system are perverted. Here the drug exerts its baneful effects, and the mind rapidly succumbs to a power over which it has no control. The period of excitement is absent, the predominating desire of the patient being to *sleep*, and from the dull, lethargic stupor which supervenes he is roused only by vigorous and unremitting treatment. Giddiness portends this mental and physical state. The pulse, though still full, diminishes in fre-

quency; the breathing becomes heavy and labored, and finally stertorous; the heart is now apparently seized with indefinable oppression, and the pupils are visibly contracted; the skin is dry and warm, and the face suffused or at length of a marked cyanotic hue, cutaneous eruptions being not uncommon. Should relief be not forthcoming, the pulse continues to sink; the drowsiness and subsequent lethargy are followed by a state of true coma; the muscular system is wholly relaxed; the reflexes are obliterated, and death ensues from respiratory failure, the asphyxia being closely accompanied by cessation of the heart's action.

Although this stage of toxemia is not necessarily fatal, it will be readily seen that its alarming manifestations demand the utmost skill and vigilance on the part of the physician. In fact, the diagnosis is not always clear, the phenomena so nearly resembling those of alcoholism, especially apoplexy, uremia, and congestion of the brain, that it is at times next to impossible to predicate from symptoms alone the presence of opium-poisoning. It may be observed, however, that, save in certain exceptional cases, contraction of the pupil is wanting in apoplexy, while there is present partial distortion of the face or paralysis of the limbs. From uremia opium-poisoning is differentiated by the presence in the former of edema and by albumin and casts in the urine.

The *treatment of acute opium-poisoning* covers an ample field of therapeutic experience, the remedies employed being numerous, and in their physical properties often widely diverse. Three objects are of paramount necessity: to evacuate the stomach, maintain respiration, and prevent failure of circulation. The first of these may be attained by the use of the stomach-pump or siphon-tube (easily improvised). Active stimulants and irritating emetics are of great service, the latter being assisted by frequent and copious draughts of warm water in the intervals of vomiting, and the doses being large in order to make an impression upon the insensibility of the stomach. Various agents, including chemical antidotes, may aid recovery—tannic acid, permanganate of potassium, strychnine especially, atropine, strong black coffee, hypodermic injections of apomorphine, etc.—and other resources have been tried with varying success. Warm water injected into the rectum and stomach has proved efficacious. Counter-irritants, flagellation, shouting in the ear, may rouse the patient from his lethargy. Should artificial respiration become necessary, either Sylvester's method or the use of the faradic current can be

adopted. It is here of great importance that the subject should be kept awake, that he may voluntarily assist in the recuperative process, which while the will is quiescent in sleep he is unable to do. The full force of the faradic battery may be used, but it should never be applied to the phrenic nerve directly, lest paralysis of the cardiac muscles ensue. Should the bodily temperature fail to be sustained, external heat should be employed to supply the deficiency.

In maintaining the circulation strychnine and atropine, both powerful antidotes to opium, will be of great value. Rubbing, massage, flagellation—but never such as to produce exhaustion—and, if necessary, moderate venesection, may be used as supplementary efforts at restoration. Walking the patient will often ward off somnolence, the exercise being continued until thorough wakefulness results, provided there be no untoward muscular debility. Inhalations of ammonia have proved efficacious, and the use of the catheter has been found to stimulate excretion by the kidneys. Special efforts should be directed, however, toward sustaining respiration, since failure in this respect is most to be feared. Should the breathing be normally resumed, or even partially so, there is no special danger to be apprehended from the state of coma. Cerebral effects have sometimes been relieved by quinine. The use of atropine is not to be encouraged, save in exceptional cases—and then without repetition—since it may prove irritating to the cardiac ganglia, while continued doses are liable to induce belladonna-poisoning, as dangerous as the original condition.

In the choice of remedies it should be borne in mind that the influence of opium is limited to the nervous system, and that lethal doses tend to cause paresis of the arterioles and veins. Each case, moreover, is to be studied individually, scarcely any drug being more dependent than opium upon the idiosyncrasies of the patient.

Chronic opium-poisoning, resulting from the habitual use of opium, its most active constituent morphia, or its salts, is undoubtedly one of the most pernicious habits to which the human system can be subjected, its mental, moral, and physical phenomena being among the saddest and most terrible known to therapeutics.

The symptoms of this disease of mind and body are in some respects similar to those of acute opium-poisoning in their physiological aspect, but the psychological features of the malady are more abhorrent and less amenable to treatment. Extreme nervous-

ness and tremors; abnormal exercise of cerebral functions, manifested in extraordinary hallucinations; hypochondria; anxiety; insomnia; spasms and painful neuralgia; and not infrequently suicidal intent or mania,—these are among the prominent characteristics which mark the victim of the opium habit. The physiological symptoms include dryness of the tongue; vesical irritation, with possibly excessive urinary discharge; constipation; serious disturbances of the sexual function, resulting in impotence or suspension of catamenia; while caries of the teeth is also sometimes present,—the derangement of the system being wellnigh complete, often beyond the reach of therapeutic aid. In the words of a votary to the habit, "My head throbs like a trip-hammer; my teeth are set; a metallic taste is in my mouth; my face, neck, and arms are red as fire, and all the veins swollen. Worst is the throbbing in my head."

The conditions inducing the opium-habit are frequently caused, or are largely influenced, by the therapeutic employment of the drug—as was the case with De Quincey, whose graphic analysis of the Pleasures and *Pains* of opium, if possibly to be taken *cum grano salis*, is at once the most powerful and the most eloquent ever written. The patient who has once experienced the anodyne influence of the drug—as captivating to his senses as though it were a draught of fabled Lethe—readily yields to it upon the slightest occasion, as, for instance, to alleviate trivial indispositions for which, in ordinary circumstances, he would ridicule the idea of medical treatment. With repeated indulgence—often promoted by a casuistic reasoning of which by degrees the subject is scarcely conscious, or by persistent and intentional deception—comes the craving which knows no restraint, and which can be quieted only by complete mental and physical regeneration or the merciful release of death. Dependent for fancied happiness upon his extraneous resource, the blind idolater of personal ease pursues his *ignis fatuus* heedless of consequences, in his mental and moral degeneracy apparently lost to all finer feeling or to manlier resistance in presence of his insidious, blighting temptation. Meanwhile, physiological torpor demands an ever-increasing amount of the drug that the system may be sufficiently impressed. Psychical emotions, anxiety, anger, mental anguish, or, indeed, the most puerile pretexts, continue to furnish occasion for indulgence, and the facilities of administration afforded by the modern method of hypodermic injection unhappily serve to stimulate a longing for

momentary exhilaration or the alluring oblivion which may obliterate the past, but which reason cannot suffer to ignore the future when the mind recalls the overwhelming testimony of experience.

Should amelioration be now attempted and the drug withheld, more distressing symptoms still are developed. Depression and exhaustion are manifested at once, followed by increasing melancholia, attended by horrible visions and anxieties no mental energy —such as remains of it—can dispel. The pulse is scarcely perceptible; the patient is in a state of nervous tension, occasionally evinced by paroxysms of despair; and in the deprivation endured the poor wretch, with outstretched hands and imploring expression, begs, screams, for morphine, laudanum, or other habitual form of opium, at last breaking down utterly in a fit of passionate weeping when denied the solace craved. It is, indeed, an appalling spectacle of human misery which, could it be witnessed by those in whose imaginations the first subtle effects of opium awaken dreams of elysium, might well persuade the victim to forswear a gratification for which so tragic a fate is reserved.

The treatment of so dire a malady—for such the chronic use of opium must be regarded—demands the utmost forethought, patience, and tact. The method of sudden, absolute withdrawal of the drug is admitted by the wisest observers to be fraught with danger commensurate with that of the indulgence to be overcome. Collapse, insanity, and other serious results have attended so drastic a measure, the general opinion obtaining to-day being that a gradually reduced dose of the drug is the safest and most rational mode of procedure. The conditions are extremely difficult to combat successfully, repeated hypodermic injections being eradicated from the system far less readily than opium from the stomach. The moral nature of the patient, too, has become so perverted that little or no reliance can be reposed in his veracity, the physician being thrown upon his unaided resources, supplemented by the untiring vigilance and fidelity of the attendant.

The gravity of the situation should from the first be fully realized, since it is too often simply a case of life or death, the patient being not infrequently seized with the desire of self-destruction in the extremity of mental anguish occasioned by the ordeal imposed by unwonted abstinence. Could he be put upon his honor, and that honor be steadfast, his co-operation would be invaluable. But this assistance is seldom at command, the patient's loyalty of purpose and unswerving resolution, as professed, being wholly sub-

servient to a volition long since weakened, if not annihilated, by pitiful sophistries and moral degradation. Nevertheless, the case must be approached from the sympathetic side, and every means of inspiring confidence employed, remembering that a human will as well as body is under treatment, and that mental sanity as well as physiological health is to be restored.

Of the many agents suggested by therapeutic science, valerianate of ammonia, fluid extract of coca or camellia, judicious tonics, easily digested and strengthening food, and, if necessary, alcoholic stimulants, have been especially beneficial. Other remedies, such as dilute phosphoric acid, tincture of lupulin, codeine, trional, conium, and cannabis Indica, have in many cases proved efficient.

Change of scene, a healthful, stimulating diet, and abundant out-door exercise—always favorable to diversion of thoughts—seldom fail to react encouragingly upon the mind and physique of the patient. The exhibition of symptomatic remedies not indicated has been authoritatively condemned, the primary object of treatment being not so much to afford temporary relief of pathological conditions as to remove the dominating cause. Cocaine has also been discouraged, lest its use generate habitual desire for the drug. In conclusion, it may be said that the obstacles attending a complete mastery of the opium habit by means of therapeutic resources are apparent from the fact that but a small proportion of patients addicted to the use of morphine are permanently cured. Yet, though the admission be made with regret, it is no disparagement to professional science nobly directed, and assuredly carries with it a fearful warning to those who are tempted to seek immunity from mortal ills by purblind indulgence in so fatal a medium of relief.

Therapeutics.—In a general way, the medical uses of opium are—1, to relieve pain; 2, to produce sleep; 3, to lessen reflex irritation; 4, to diminish secretion; 5, to support the system; 6, to act as a sudorific.

Opium is the most important and useful drug known to medicine, as well as the most remarkable in its multifarious applications. It would, therefore, be idle—indeed, wellnigh impossible—to enumerate all the maladies and abnormal conditions for which this invaluable remedy has been employed. It perhaps best represents the typical symptom medicine, being used almost invariably for the relief of one or more symptoms of disease, rather than for its specific or direct curative action upon the disease itself. Unless some

special contraindication exists, it may be employed when any of the above medical uses are desired.

Externally and Locally.—It is used to relieve pain, either in the form of an ointment, a liniment, or a suppository, an aqueous solution of morphine sulphate as a collyrium in *conjunctivitis*, in the form of bougies, injections, snuff, or lozenges, or solution in diseases of the *genito-urinary tract*, the *ear*, *nose*, and *throat*.

Tincture of opium is frequently added to flaxseed poultices to allay the pain of *superficial inflammation*.

Internally.—Either OPIUM or MORPHINE may be used for the relief of *pain*, regardless of the seat or cause. Pain of moderate intensity may often be allayed by other anodynes, such as antipyrine, exalgin, etc.; but when it is severe or excruciating, it is useless to experiment with other drugs when so potent an agent for relief as opium is obtainable.

It is not recommended for ordinary use to produce sleep, because of its seductive, insidious action and the danger of creating in the patient a tendency toward the opium habit. When, however, sleeplessness is occasioned by pain, and in the *insomnia of delirium tremens* or *acute mania*, opium or some one of its preparations is often an indispensable remedy.

Spasmodic conditions of involuntary muscles, as in cases of *asthma*, the convulsions of *tetanus*, *uremia*, *hydrophobia*, *chorea*, etc., frequently call for a drug as powerful as opium.

The paroxysms of *periodical fevers*, and especially the *congestive chills of virulent malaria*, often yield more readily to this medicine than to quinine.

In *dysentery*, *cholera morbus*, and *cholera* it has been used with excellent results, having also been employed in many cases of excessive secretion in other portions of the body.

OPIUM is frequently given in *bronchitis* with profuse secretion and irritable cough, in which condition it acts favorably through depression of the reflexes and power to allay irritation and check secretion. In these cases, however, small doses only should be administered, and the condition of the patient carefully watched, especially that of the aged, lest the respiratory apparatus be so depressed that expulsion of the accumulated viscid mucus be impossible and danger of death from suffocation ensue.

As a supporter of the system when the vital forces are weakened by acute or chronic disease or injury there are but few drugs as efficacious as opium. It calms and strengthens the debilitated

heart, and secures to the patient refreshing sleep, soothing and invigorating his system by means of the much-needed rest. If pain be persistent, wearing seriously upon the sufferer's vitality, opium by its anodyne influence enables him to recuperate during the interval of relief.

One of its most valuable services is in *peritonitis*, although, notwithstanding its incomparable value, some surgeons, more scientific than practical, have subordinated it to the treatment by free purgation with saline cathartics or the irrigation of the peritoneal cavity with antiseptic solutions in order to eradicate from the sac the pathogenic bacteria.

Despite the skepticism and opposition of abdominal surgeons, opium still remains, and justly so, the abiding resource of the great mass of conscientious physicians.

When given in proper doses in peritonitis, opium reduces peristalsis and removes the pain, promoting the patient's comfort and supporting his vital powers. It diverts the blood from the congested peritoneum by dilating the cutaneous blood-vessels. Furthermore, it possesses the peculiar property of causing the irritation in the inflamed area to contract reflexly the local blood-vessels, thus diminishing the blood-supply to the diseased part.

In *shock* from severe injury, opium, by benumbing sensation and depressing the reflex mechanism, lessens the danger of cardiac and respiratory failure.

In *pleurisy* it is the most efficient remedy, relieving congestion as in peritonitis, besides reducing the respirations, and consequently the friction of the inflamed pleural surfaces, as well as allaying the pain accompanying each respiration.

DOVER'S POWDER is a common and valuable agent in *acute coryza*, it also being one of the most efficient diaphoretics.

OPIUM is considered the most efficacious remedy in *puerperal septicæmia*. It has also been advocated for *hemorrhage*, both active and passive, its greatest utility being manifested in the latter condition.

Although frequently used in *continued fevers* of various kinds, it is indicated as a rule only during their course—or, rather, after the fever is well established or during its decline—to mitigate its violence or conserve the strength and relieve the nervous manifestations foreboding exhaustion. Clinical experience has demonstrated its inutility, ordinarily, at the onset or climax of such fevers.

Even in *exanthematous fevers* opium has proved valuable when the eruption is delayed.

As already intimated, the space allotted to this drug will scarcely permit an enumeration of the many disorders for which this remedy has been successfully administered. The independent and thoughtful physician, knowing the chief indications for its use, will find no difficulty in employing opium alike to the relief of the patient and his own satisfaction.

Contraindications.—If avoidable, opium should not be given to children under five years of age. Should the necessity of administration under that age be deemed advisable in the judgment of the physician, it should be remembered that the drug acts with greatly disproportionate power upon the nervous systems of the young, 1 minim (0.06 Gm.) of tincture of opium having caused the death of a child one day old, and a few drops of camphorated tincture of opium having proved fatal to an infant of nine months. The death is even recorded of a nursing babe, from the mother having taken a medicinal dose of laudanum.

Opium is contraindicated in excessive bronchial secretion of the aged during the second stage of pneumonia, in cerebral congestion, and in alcoholism.

Administration.—As has been stated under *Poisoning*, there are many circumstances which modify the action of opium, the young and the old requiring smaller doses and great care in administration. For children the best preparation is paregoric. Females, moreover, need smaller doses than males, since they are more readily affected by the drug and more subject to untoward manifestations, such as nausea, headache, etc.

Caution should be exercised in administering opium to those who have an idiosyncrasy against it. On the other hand, persons addicted to the opium habit require enormous doses to make a medicinal impression.

Agonizing pain seems to antagonize the drug, so that in *peritonitis* or during the passage of *biliary* or *renal calculi*, in *severe neuralgia*, *tic douloureux*, etc., opium is well borne, doses which under other conditions might produce dangerous symptoms having little effect save to deaden the pain, frequently not even inducing sleep.

In other cases, such as *nephritis*, very small doses may be followed by serious and alarming consequences, continued administration resulting in an accumulation of the drug in the system,

owing to defective elimination. Should prolonged administration be desirable, it is necessary to increase the dose gradually in order to produce the requisite effect, because of the growing insensibility to the drug.

Certain preparations are preferable in given conditions. Thus, if it be necessary to produce diaphoresis, Dover's powder or some other combination with ipecac is advisable. When relief of pain, unless it be intense, is desired, small doses of morphine or tincture of opium will usually be sufficient, full doses being required to produce sleep.

The deodorized tincture of opium causes less disagreeable symptoms than the plain preparation, which contains narcotine. Potassium bromide is said to prevent untoward after-effects.

When opium is demanded for its astringent action, it should be given in small or stimulant doses or combined with chalk or with some of the astringents. The camphorated tincture, owing to the camphor it contains, is probably the most astringent liquid preparation of opium, and is therefore preferable in cases of diarrhea, as it is the favorable form as an adjunct to cough-mixtures.

When the prolonged sedative and astringent effect of opium is desired, as in *intestinal hemorrhage, diarrhea, nausea,* and certain *diseases of the stomach,* an old, dry opium pill or pill of opium and lead is better than any liquid preparation or morphine, owing to its tardy solution.

In *diseases of the rectum* requiring opium a suppository containing the extracts of opium and belladonna is perhaps the best combination to use.

Ovarian and *pelvic pain* more readily succumbs to the anodyne action of codeine than distress in other parts of the body.

When opium is used as a soporific, it is best to combine it with chloral, a small dose only of each being necessary. These unite in their action upon the brain, depressing the heart less than if chloral alone had been given, and attended by less serious after-effects than had morphine been the sole agent employed.

Opium prolongs the narcotic effect of chloroform, and in certain operations it is good practice to administer a dose of the drug, following it soon with a few inhalations of the anesthetic.

The hypodermic injection of morphine is usually preferable to the internal administration of opium in cases of severe pain, since a smaller dose is required and a much more rapid effect produced, with less danger of affecting the appetite and bowels.

The many circumstances influencing the action of the drug appear to confirm the statement that "there is no *dose* of opium," its conduct being wholly dependent upon the age, sex, idiosyncrasies, and condition of the patient. The amounts given under the different preparations are such as experience has shown to be safe ordinarily as the initial ones for adults, succeeding doses being adjusted according to the indications of the individual case.

Opium compared with its Alkaloids.

Morphine does not stimulate the nervous and circulatory systems so much as opium, nor is it so decided a narcotic or convulsant. Morphine is more apt to excite nausea and vomiting, and its sequelæ are of longer duration.

Opium slightly increases the temperature—morphine lowers it; and, while the former accelerates, the latter retards the pulse.

The continued use of morphine hypodermically tends to constipate, while its prolonged action upon the stomach is apt to occasion diarrhea: under like circumstances opium does not produce diarrhea, its only effect being a cessation of confinement in the bowels. Morphine, therefore, ingested, fails to constipate, while opium is the better drug to check diarrhea.

Morphine is excreted more readily than opium, and does not affect the secretion of bile.

Opium possesses greater diaphoretic properties than morphine.

Morphine produces more irritability of the bladder, frequently causing ardor urinæ. It also occasions much greater itching of the skin, which usually begins and is intense about the eyes and nose. In its action as an anodyne and soporific morphine is more rapid and certain than opium.

Codeine is a much feebler anodyne and hypnotic than morphine, 4 grains (0.25 Gm.) being about equivalent to 1 grain (0.06 Gm.) of the latter drug. It produces sleep, however, freer from disturbance, with a less disagreeable sequel.

Codeine has a more marked and selective action than morphine upon the nerves of the abdominal viscera.

It possesses an advantage over both opium and morphine in that it can be given in increasing doses without producing narcosis.

It is more stimulating to the spinal cord and sedative to the pneumogastric nerve than morphine.

Codeine is superior to opium or morphine as a stimulant to the glycogenic function of the liver. In the treatment of *diabetes mel-*

litus it surpasses all other drugs, almost invariably lessening, and often entirely removing, the sugar from the urine. In justice, however, to authorities so eminent as Bruce, Frazer, and Osler it may be said that they consider morphine much more reliable than codeine in diabetes, regarding the latter as nothing save a weak or diluted morphine.

Admitting the general correctness of this opinion, codeine is nevertheless preferable to morphine or opium in prolonged administration, as is necessary in diabetes, at least for the reasons that no untoward manifestations accompany its use, and that it does not engender an habitual proclivity for the drug.

Finally, codeine is a valuable remedy in troublesome or nervous *cough* or to quiet the cough in *bronchitis* and *phthisis*, and is also efficient in *gastrodynia*. Codeine should be administered in water, syrup, elixir of orange, or in the form of pills or capsules.

The true action of the following alkaloids is so questionable that they are seldom, if ever, prescribed:

Narceine is alleged by equally competent observers to possess feeble hypnotic properties and to be practically inert.

Narcotine is a misnomer, the preparation being devoid of narcotic power, although it is said to possess marked stomachic and antiperiodic properties.

Papaverine is a mild hypnotic and cardiac sedative.

Thebaine is a powerful tetanizing poison, its action upon the spinal cord being analogous to that of strychnine and brucine.

Hūmulus—Hūmuli—Hops. *U. S. P.*

Origin.—The strobile-like aments of *Humulus lupulus* L., a rough, climbing perennial, native and cultivated in the north temperate zone.

Description and Properties.—Ovate, about 1¼ inches (3.17 Cm.) long, consisting of a thin, hairy, undulating axis and many obliquely ovate, membranaceous scales, the upper portion of which is reticulately veined and the lower parallel-veined, glandular, surrounding a subglobular akene; color of the scales greenish, free from reddish or brownish spots, odor aromatic, and taste bitter, aromatic, and slightly astringent. The active and important constituent is—

Lupulīnum—Lupulīni—Lupulin. *U. S. P.*

Origin.—A glandular powder separated from the aments of *Humulus lupulus.*

Description and Properties.—Bright, brownish-yellow, becoming yellowish-brown, resinous, consisting of minute granules which under the microscope are seen to be subglobular, or, rather, hood-shaped, and reticulate—aromatic and bitter.

Dose of Lupulin.—5–30 grains (0.3–2.0 Gm.).

Official Preparations of Humulus.

Tinctūra Hūmuli—Tinctūræ Hūmuli—Tincture of Hops.—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Official Preparations of Lupulin.

Extrăctum Lupulīni Flūidum—Extrăcti Lupulīni Flūidi—Fluid Extract of Lupulin.—*Dose*, 5–30 minims (0.12–2.0 Cc.).

Oleoresīna Lupulīni—Oleoresīnæ Lupulīni—Oleoresin of Lupulin.—*Dose*, 1–5 grains (0.06–0.3 Gm.).

Unofficial Preparations.

Infūsum Hūmuli—Infūsi Hūmuli—Infusion of Hops.—*Dose*, 1–4 ounces (30–125 Cc.).

Tinctūra Lupulīni—Tinctūræ Lupulīni—Tincture of Lupulin.—*Dose*, ½–2 fluidrachms (2–8 Cc.).

Antagonists and Incompatibles.—Mineral acids and metallic salts.

Synergists.—Alcohol; opium, lactucarium, and many other narcotics.

Physiological Action.—*Externally and Locally.*—Hops are sedative and astringent.

Internally.—Digestive System.—The action of hops is similar to that of vegetable bitters, augmenting the secretions from the salivary and gastric glands, thereby promoting appetite and digestion.

Circulatory System.—The heart's action is slightly increased, the remedy also raising arterial tension and exciting the cutaneous circulation.

Nervous System.—Like opium, hops primarily stimulate the brain, and secondarily act as a mild soporific. These effects are increased if the preparation be an alcoholic one, such as beer. The hypnotic action is due partly to the volatile oil which the hops contain.

Respiratory System.—They slightly stimulate the respiration.

Absorption and Elimination.—The active principles of hops are chiefly eliminated by the skin and kidneys, increasing considerably the sweat and urine.

Temperature is unaffected.

Untoward Action.—None is noticeable, although the drug possesses marked aphrodisiac properties.

Therapeutics.—*Externally and Locally.*—The sedative action of hops is utilized in what are known as hop poultices in *superficial* and *abdominal inflammations*, in *orchitis*, and as a preventive of *chordee*.

A hop pillow is frequently employed to induce sleep and allay the pain of *earache*, while, if the pillow be moistened with weak vinegar and the fumes inhaled, the result is found to be efficacious in the treatment of *inflammatory conditions of the upper respiratory passages*.

Internally.—Its stomachic and carminative properties render this remedy valuable in *atonic dyspepsia*, so called, and in *flatulent colic*. Preparations of hops are also useful in *febrile restlessness*.

Priapism, *perverted sexual appetite*, *spermatorrhea*, etc. may be relieved by lupulin.

The combined tinctures of lupulin and capsicum serve as excellent substitutes for alcoholic stimulants during the treatment of *alcoholism*, as well as being useful remedies in mild attacks of *delirium tremens*.

Administration.—Lupulin and oleoresin of lupulin are best given in pills and capsules respectively. The tincture and fluid extract should be administered in syrup.

Lactucārium—Lactucārii—Lactucarium. *U. S. P.*

Origin.—The concrete milk-juice of *Lactuca virosa* L., a biennial rank-smelling herb growing in Europe.

Description and Properties.—It occurs in sections of plano-convex, circular cakes, or in irregular, angular pieces, externally grayish-brown or dull reddish-brown, internally whitish or yellowish, of a waxy lustre, heavy, narcotic odor, and somewhat bitter taste. It contains lactucin, lactucopicrin, lactucic acid, lactucerin, and wax.

Dose.—5–60 grains (0.3–4.0 Gm.).

Official Preparations.

Tinctūra Lactucārii—Tinctūræ Lactucārii—Tincture of Lactucarium.—*Dose*, ½–2 fluidrachms (1.0–8.0 Cc.).

Sȳrupus Lactucārii—Sȳrupi Lactucārii—Syrup of Lactucarium.—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Synergists.—The same as for opium.

Physiological Action and Therapeutics.—Its action closely resembles that of opium, save that it is very feeble, in adults never producing alarming symptoms. It is slightly soporific and anodyne, and also diuretic, which properties, especially in the syrup form, render it of some value in cases of *irritating cough*, as well as in *sleeplessness* and *nervousness of children.*

Lactucin may be given in doses of from 1 to 5 grains (0.06–0.3 Gm.) as a mild sedative and hypnotic.

Cănnabis Ĭndica—Cănnabis Ĭndicæ—Indian Cannabis. *U. S. P.*

(Indian Hemp.)

Origin.—The flowering tops of the female plant of *Cannabis sativa* L., grown in the East Indies.

Description and Properties.—The article of commerce consists of bundles of a few flowers, the branches and bracts, and nearly ripe fruit, the whole more or less agglutinated by a resinous exudation. Of a brownish-green color, peculiar, narcotic odor, and slightly acrid taste. The drug contains a resin, *cannabin*, a brown, amorphous powder soluble in absolute alcohol, and a volatile oil.

The crude drug is commonly called in India "gunjah." "Bhang," "siddhi," or "hashish," the term usually employed—from whose toxic effects, frequently inciting to murder, is said to be derived our word "assassin"—is another form of cannabis appearing as the Arabian confection prepared by mixing aromatics with fruits and dried leaves.

Dose.—2–5 grains (0.12–0.3 Gm.).

Official Preparations.

Extrăctum Cănnabis Ĭndicæ—Extrăcti Cănnabis Ĭndicæ—Extract of Indian Cannabis.—*Dose*, ¼–1 grain (0.015–0.06 Gm.).

Extrăctum Cănnabis Ĭndicæ Flŭidum—Extrăcti Cănnabis Ĭndicæ Flŭidi—Fluid Extract of Indian Cannabis.—*Dose*, 2–5 minims (0.12–0.3 Cc.).

Tinctūra Cănnabis Ĭndicæ (15 per cent.)—**Tinctūræ Cănnabis Ĭndicæ—Tincture of Indian Cannabis.**—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Unofficial Preparations.

Cănnabine Tannate.—*Dose*, 2–10 grains (0.13–0.60 Gm.).

Cănnabinone.—*Dose*, ½–1 grain (0.03–0.06 Gm.).

Antagonists and Incompatibles.—Strychnine, caustic alkalies, acids, and aqueous preparations are pharmaceutical incompatibles, precipitating the resin.

Synergists.—Alcoholics, ether, bromides, cocaine, and members of the present group enhance its cerebral effects.

Physiological Action.—*Externally and Locally.*—Its only local action is that of a feeble sedative.

Internally.—Digestive System.—It is slightly sedative to the stomach, in many persons appearing to promote the appetite and aid digestion. Its use is not followed by constipation or other gastro-intestinal disturbance.

Circulatory System.—A slight acceleration of the pulse is noticeable, probably due more to the stimulation of the nervous system than to any direct action upon the circulatory apparatus.

Nervous System.—Like opium, it primarily stimulates the brain, large doses producing a peculiar exhilaration and subsequent reaction more fully described under *Poisoning.* The period of excitation is more prolonged than with opium, but is eventually succeeded by sleep—almost always disturbed by dreams and spectral illusions. The coma resulting from cannabis is never so profound as in the case of opium.

It is like the latter drug as an analgesic, but feebler in its action. It is unlike opium in producing a sensation of tingling and numbness, through its effect upon the sensory nerves, followed by cutaneous anesthesia, accompanied by muscular debility and frequently a cataleptic condition.

Respiratory System.—No marked or uniform action upon the respiration has been observed, it being at times quickened and again retarded, though the effects are less pronounced than with opium.

Absorption and Elimination.—Cannabis is slowly eliminated, though in what manner is unknown, the effects of the drug sometimes persisting for twenty-four or thirty-six hours. Of all the secretions, the urine alone is affected, the amount being increased.

Temperature.—Cannabis has no direct depressing action upon temperature, which, however, may rise during the period of excitation and be diminished somewhat during sleep.

Eye.—The drug differs from opium in that it dilates the pupil and produces exaggerated vision.

Uterus.—It is considered to be a powerful uterine stimulant, and like properties are usually ascribed to it as an aphrodisiac, though

its effect upon sexual desire is not always manifest. It undoubtedly increases the energy of the uterus, though possessing no power to inaugurate uterine contractions when once suspended.

Untoward Action.—The uncertain effects of different preparations, together with varying susceptibilities to the drug, render it almost impossible to cite any characteristic untoward symptoms. Certain of the effects described under *Poisoning* may be present even under small doses in persons having an idiosyncrasy against the remedy.

Poisoning.—Large doses of cannabis Indica are wont to produce toxic effects which in their manifestations present a singular study of psychological phenomena, varying with the temperament and idiosyncrasies of the subject, yet in certain characteristics common to all who experience the full force of the drug. The transition from the influence of medicinal doses to that exerted by poisonous absorption is often gradual, many features of the conditions resulting therefrom being strikingly similar.

Moderate administration, however, is seldom attended by untoward effects, whereas toxic doses, in place of emotional delight—among the earlier sensations—develop an intensity of mental anxiety which even contemplates death as the inevitable issue of the malady. The buoyancy of spirit, the soothing calm and *insouciance*, the ecstasy of an ethereal mood by which finer natures are swayed,—these have given place to a mental and physical oppression best described as "a sensation as of the brain boiling over and lifting the cranial arch like the lid of a tea-kettle." Not infrequently the blissful *nirvâna* induced by moderate doses is rudely broken by an intemperate use of the drug, extreme violence and even murderous thoughts supplanting calmer reveries and the intellectual solace of passive emotions. Especially is this true among Oriental nations—the Hindustanis, for example—addicted to excessive indulgence in *bhang* or *hashish*, the form of the drug generally employed, its effects upon the grosser passions rivalling those of opium among the Malays.

Among the most curious and striking of the psychological phenomena attending immoderate doses of hashish is the abolition of space and time. So manifold are the images which throng the imagination, and so rapid and intense the impressions made upon the mind, that the sense of proportion and the normal relations of material objects become wholly lost. Thus, the furniture in the room may appear infinitely removed to the distorted vision, while

a few seconds of time may be prolonged by the disordered fancy into hours, days, weeks, and even years. These hallucinations, strangest of all, are not accompanied by corresponding loss of reasoning power, the intellect taking cognizance frequently of the true relations of external things, as if aware of its own abnormal condition. Nor is volition seriously affected, the mental lesion, so to speak, existing rather in lack of coördination between consciousness and the imaginative faculty.

These spasmodic or persistent hallucinations are often associated with a haunting sense of dual existence, in which all trace of personal identity is for the time either obliterated or hopelessly confused. During a certain stage of poisoning, moreover, the conviction of impending death takes possession of the mind; fear and desperation seize upon the bewildered faculties, intensified by an impression of physical dissolution; and the subject endures unspeakable anguish, in which gloomy forebodings of disaster contrast terribly with the buoyancy, the temporary joy, and peals of laughter accompanying the earlier effects of the drug.

Upon regaining his normal condition the hashish-eater is either wholly oblivious of the events which have transpired during the interval of intoxication, or recalls vividly the scenes and incidents through which he has passed. As in the case of opium, the peculiar influence of the drug is largely dependent upon temperament, sex, age, and idiosyncrasy. A refined and noble intellect, like De Quincey's, might readily be moved to gentler emotions and sensibilities suffused with human sympathy and love. A baser, more unfeeling nature might exhibit latent symptoms of ungovernable passion manifested in sensual or criminal conduct scarcely conceivable either to himself or to others.

The physiological symptoms characteristic of cannabis-poisoning are well marked, the drug acting reflexly yet powerfully upon the mental state. Loss of consciousness, followed by collapse or stupor, or in some cases resulting in catalepsy and convulsions, in all cases complete anesthesia, and in very many a depression of the precordium, a sensation of arterial contraction, and cardiac palpitation, are among the prominent features of the malady. The sight and hearing are perceptibly rendered more acute; the pupils are dilated, although contracting to light; the reflexes are lowered by stimulation of inhibitory centers; and an oppressive sense of paralysis in the extremities induces horror and despair. The urinary secretions are augmented, although constipation seldom occurs,

and a ravenous appetite almost invariably attends the toxic phenomena.

Occasionally there is experienced great difficulty in breathing, as if the lungs were on the point of bursting. An increase of sexual desire is common, although the aphrodisiac properties of the drug are not always present.

The after-effects of hashish indulgence vary with the physiological and mental peculiarities of the individual. As a rule, they are not disagreeable, though it requires time to eradicate the effects of the poison. Death directly attributable to the drug has not been recorded.

Treatment of Poisoning.—Among antidotes, lemon-juice, coffee, and tobacco have been favorably mentioned. The best treatment appears to be similar to that adopted in cases of chloral- and opium-poisoning.

Therapeutics. — *Externally and Locally.*—Cannabis is very seldom used locally, although it is an ingredient of a powder recommended by W. H. Beverly for insufflation in *hay fever.*

Internally.—Cannabis has been discarded as a remedy in many disorders for which it was formerly used. It is, however, still employed to a considerable extent as an hypnotic in *melancholia* and *mania* and for its anodyne and anesthetic action in *neuralgia* and *pruritus.*

As a uterine tonic and anodyne it has been found efficient, either alone or in combination with other medicines, in *subinvolution, chronic metritis, dysmenorrhea, menorrhagia,* etc.

Probably there is no remedy superior to cannabis Indica in functional *impotence,* its action in this disorder being aided by combining it with ergot and nux vomica.

It is a valuable adjuvant to cough-mixtures intended to relieve *tickling* or *irritation of the throat,* as well as to quiet the excessive cough of *bronchitis* or *phthisis,* being superior to opium in this respect, since it disturbs the stomach less and does not produce constipation.

It has been used in *spasm of the bladder,* and in *gonorrhea* and *chordee* it has been found to be a most valuable remedy.

In considering the therapeutics of cannabis Indica reference should be made to its efficacy in *migraine* and *headaches,* particularly those present at the menopause. Although as a remedy for the former disorder cannabis has been largely superseded by the adoption of antipyrine and agents of its class, the old use of tinc-

ture of gelsemium, combined with tincture of cannabis, serves an important purpose in aborting the distressing attacks of *migraine*.

Administration.—The extract should be given in pill form; the tincture and fluid extract, in an alcoholic menstruum. As has been already intimated, different samples vary greatly in strength; it is therefore best to begin with the minimum dose until the force and quality of the preparation be ascertained.

It is advisable to prescribe invariably the preparations of that particular manufacture which experience has shown to produce samples of uniform strength.

The following drugs—Belladonna, Stramonium, Hyoscyamus—belong to the Solanaceæ, and are by some authors classed as Mydriatics, on account of their characteristic action on the pupil. It has been thought best in the present work to include them in the subdivision of Narcotics, because of their narcotic properties, utilized clinically in the treatment of diseased conditions.

Belladonna is considered the type of the Mydriatic Narcotics, and claims the first attention. Two portions of the plant are used—the leaves and the root.

Belladŏnnæ Fōlia—Belladŏnnæ Foliōrum—Belladonna Leaves. *U. S. P.*

Origin.—The leaves of *Atropa Belladonna* L., a nearly glabrous, herbaceous, perennial plant, from 4 to 6 feet (1.2–1.8 M.) high, bearing dark-purple, bell-shaped flowers and shining purplish-black berries of the size of a cherry. It is found in the woods, chiefly in the mountainous districts, of Central and Southern Europe, and as far east as Asia Minor, Caucasia, and Central Asia. It is cultivated in Europe and in the United States to some extent, being known by the common name of "deadly nightshade."

Description and Properties.—The leaves are from 4 to 6 inches (10–15 Cm.) long and about one-half as broad, broadly ovate, equilaterally narrowed into a petiole, tapering at the apex, entire on the margin, smooth, thin, the upper surface brownish-green, the lower surface grayish-green, both surfaces whitish punctate; odor slight, taste bitterish and disagreeable.

Belladonna leaves contain from 0.2 to 0.6 per cent. of *atropine*, the most important alkaloid, *belladonnine* (probably anhydro-atro-

pine), besides an alkaloid identical with *hyoscyamine*, *duboisine*, *daturine*, *atropamine*—sometimes present—and chrysatropic acid (scopaline).

Dose.—1–5 grains (0.06–0.30 Gm.).

Official Preparations.

Extractum Belladonnæ Foliorum Alcoholicum—Extracti Belladonnæ Foliorum Alcoholici—Alcoholic Extract of Belladonna Leaves.—*Dose*, $\frac{1}{6}$–$\frac{3}{4}$ grain (0.008–0.048 Gm.).

Emplastrum Belladonnæ (20 per cent.)—**Emplastrum** (acc.) **Belladonnæ—Belladonna Plaster.**—For external use.

Formula: Alcoholic Extract of Belladonna Leaves, 200; Resin Plaster, 400; Soap Plaster, 400.

Tinctura Belladonnæ Foliorum (15 per cent.)—**Tinctura Belladonnæ Foliorum—Tincture of Belladonna Leaves.**—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Unguentum Belladonnæ (10 per cent.)—**Unguenti Belladonnæ—Belladonna Ointment.**—For external use.

Formula: Alcoholic Extract of Belladonna Leaves, 10; Diluted Alcohol, 5; Benzoinated Lard, 85.

Belladonnæ Radix—Belladonnæ Radicis—Belladonna Root. *U. S. P.*

Description and Properties.—The root of *Atropa Belladonna* occurs in cylindrical, somewhat tapering, longitudinally wrinkled pieces, $\frac{1}{2}$ inch to 1 inch (12–25 Mm.) thick; externally brownish-gray, internally whitish; fracture nearly smooth and mealy, not radiating or showing medullary rays in the thicker roots, except in the layer near the bark; nearly inodorous, of sweetish taste, afterward bitterish and strongly acrid.

The root contains the same constituents as the leaves, with the exception of chrysatropic acid—which is wanting—and in addition a red coloring principle, *atrosin*, found also in the berries.

Official Preparations.

Extractum Belladonnæ Radicis Fluidum—Extracti Belladonnæ Radicis Fluidi—Fluid Extract of Belladonna Root.—*Dose*, 1–3 minims (0.06–0.18 Cc.).

Linimentum Belladonnæ (95 per cent.)—**Linimenti Belladonnæ—Belladonna Liniment.**—For external use.

Formula: Camphor, 50; Fluid Extract of Belladonna Root, 950.

The important *alkaloid* of belladonna is—

Atropina—Atropinæ—Atropine. *U. S. P.*

Description and Properties.—White acicular crystals, or a more or less amorphous white powder, odorless, having a bitter,

acrid taste, gradually assuming a yellowish tint on exposure to air. Soluble in 130 parts of water, 3 parts of alcohol, 16 parts of ether, 4 parts of chloroform, and about 50 parts of glycerin.

Dose.—$\frac{1}{120}$–$\frac{1}{40}$ grain (0.0005–0.0016 Gm.).

Atropīnæ Sŭlphas—Atropīnæ Sulphātis—Atropine Sulphate. *U. S. P.*

Description and Properties.—A white, indistinctly crystalline powder, odorless, having a very bitter, nauseating taste, permanent in air. Soluble in 0.4 part of water, 6.2 parts of alcohol, 2270 parts of ether, and 694 parts of chloroform.

Dose.—$\frac{1}{120}$–$\frac{1}{40}$ grain (0.0005–0.0016 Gm.).

HOMATROPINA—HOMATROPINÆ—HOMATROPINE.

An unofficial and derivative alkaloid, obtained by the action of dilute hydrochloric acid on amygdalate of tropin. The hydrobromate of homatropine is used only as a mydriatic.

Allied Plants.

Ătropa Mandrăgora L., Mandrake, closely resembles *Atropa Belladonna*. It possesses marked anesthetic properties, and contains a mydriatic alkaloid. It is especially interesting because of its ancient history, its action having been fully described by Dioscorides and Pliny. Historians and poets have alike celebrated its peculiar and wonderful properties.

Scŏpolia Carniŏlica and **Scŏpolia Japŏnica** both resemble belladonna physically, and somewhat in their physiological action, the roots and leaves of these plants having been found mixed with those of belladonna.

Antagonists and Incompatibles.—Muscarine antagonizes the action of belladonna in nearly every particular, and physostigmine, pilocarpus, and aconite counteract many of its effects. Opium antagonizes its action on the cerebrum, pupil, heart, respiration, arterial tension, and kidneys.

Atropine is incompatible with caustic alkalies, tannin, and vegetable infusions containing tannin, an insoluble tannate of the alkaloid being formed.

Synergists.—The mydriatic drugs mentioned above aid the action of belladonna.

Physiological Action.—The action of belladonna is dependent upon the amount of atropine it contains.

Externally and Locally.—When locally applied atropine is anodyne, antispasmodic, resolvent, antisecretory, and mydriatic.

When thus used, in combination with absorbable substances—such as alcohol, camphor, animal fats, glycerin, etc.—it diminishes the sensibility of the sensory nerves, and when absorbed from raw surfaces of the skin or from the subcutaneous tissue it is capable of producing systemic effects.

Internally.—Digestive System.—Even small doses produce dryness of the mouth, owing to the greatly diminished secretion of saliva and mucus. The salivary secretion is lessened through paralysis of the peripheral endings of the chorda tympani nerve in the submaxillary gland.

The drug probably diminishes the secretions from the stomach, liver, pancreas, and intestines in a similar manner. It is reasonable to suppose that it produces these effects, since it checks all other secretions, with the possible exception of the urine. The sweat is diminished through paralysis of the peripheral nerve-endings in the sudoriparous glands. The secretion of milk is reduced by paralysis of the peripheral terminations of the secretory nerves in the mammary glands. The secretion from the bronchial mucous membranes is lessened through the depressing influence of the drug upon the nerve-endings.

Brunton claims that the peristaltic movements of the intestines are increased by small doses, large doses checking them.

This he considers due to the action of the drug upon the nervous ganglia in the walls of the intestines. It is a well-known fact that atropine paralyzes the motor nerve-endings in unstriped muscles. This is shown by its action on the vagus endings in the heart, which organ it completely paralyzes, stimulation of the vagus having no longer any effect. The action of atropine on the intestines is easily shown by exposing the intestines of a cat, the viscera being immersed in a warm, physiological salt solution. Upon the injection of muscarine the peristaltic action is much increased; but upon the injection of even a minute quantity of atropine the peristaltic action is at once arrested. It is an established fact that muscarine stimulates the nerve-endings, while the same points are paralyzed by atropine. Muscarine has no action after atropine; nor has electric stimulation of the supposed motor nerves (vagus) connected with intestines any influence, showing conclusively that atropine, even in small doses, does not increase peristalsis.

Circulatory System.—Medicinal doses of atropine or belladonna at first retard the pulse, but it is quickly accelerated and rendered

firmer, with increased arterial pressure. The primary transitory action is due to a slight stimulation of the vagi roots, the subsequent quickening of the pulse resulting from paralysis of the peripheral ends of the pneumogastric nerve distributed in the cardiac muscle. The inhibition being thus removed, the heart responds to the influence of the accelerator nerves. The center for these nerves in the medulla is also stimulated by the drug, increasing still further the rapidity of the heart's action. The cardiac muscle itself, being stimulated, renders the contractions of the heart more forcible.

Arterial tension is increased not only by the greater rapidity and force of the heart, but also by the contraction of the arterioles arising from stimulation of the vaso-motor center. Very large or poisonous doses lower arterial pressure. This effect is produced by exhaustion of the vaso-motor center from over-stimulation, resulting in dilatation of the cutaneous arterioles, which lowers arterial tension and flushes the skin. Overwhelming doses may weaken the cardiac muscle itself from over-stimulation, weakening the heart's contractions, as well as paralyzing the terminal nerve-filaments in the muscles of the vessel-walls, and even the muscular fibers.

Nervous System.—A full medicinal dose of belladonna stimulates the brain, while large doses—and, in susceptible persons, medicinal ones—may produce hallucinations and delirium, accompanied by spectral illusions. The delirium may be mild, joyful, and talkative, or it may assume a violent type. It may, moreover, persist for a long time, after which the patient sinks to sleep, induced either by exhaustion from the delirium or a secondary depressing action of the drug. True coma, like that produced by opium, rarely if ever occurs.

The spinal cord shares in the stimulation caused by belladonna. The reflexes are at first slightly exaggerated, being afterward diminished. Very often under poisonous doses there is complete motor paralysis, the loss of power occurring first in the lower extremities.

The sensory nerves are depressed, especially when the drug is locally applied, the influence being exerted on their terminal filaments. For this reason belladonna is of little service as an anodyne when given internally.

Respiratory System.—Medicinal doses quicken and deepen the respirations, owing to stimulation of the respiratory center. The

peripheral nerve-filaments of the pulmonary vagi are, however, depressed; which, were it not for the increased action of the center, would retard respiration.

Poisonous doses over-stimulate, and consequently exhaust or paralyze, the respiratory center, the result being slow and shallow breathing or perhaps death from asphyxia.

Absorption and Elimination.—Atropine is rapidly absorbed and eliminated, chiefly by the kidneys, but also to some extent by the bowels. It is said that part of the drug is destroyed by the liver.

Temperature.—Large doses slightly increase bodily heat, probably by increasing the circulation and respiration, consequently augmenting combustion. Some authors maintain that belladonna stimulates the heat-center. In cases of severe poisoning from the drug the temperature rapidly falls.

Eye.—Belladonna dilates the pupil, whether locally applied or taken internally, its effect differing from that of cannabis Indica in that the pupil cannot be made to contract by stimulation of the third nerve, although excitement of the muscle itself causes pupillary contraction. The manner in which atropine dilates the pupil is not yet satisfactorily explained, the prevailing opinion being in favor of Jessup's theory that the action is due to a stimulation of the ends of the sympathetic nerve-filaments distributed to the iris, and paralysis of the peripheral ends of the oculo-motor nerves.

Atropine increases intraocular tension, rendering it a dangerous drug in glaucomatous conditions.

Untoward Action.—Very frequently there appears, especially in children, an erythematous or scarlatinal eruption, oftener noticeable on the face and neck, but sometimes affecting the entire surface of the body. Redness and pain in the throat may also be present, but no fever, with itching of the skin or desquamation.

Occasionally instillation of atropine into the eye produces profuse lacrymation, edema of the eyelids, and blepharo-conjunctival irritation.

When taken internally in medicinal doses it sometimes occasions in certain persons vertigo, turgescence of the face, hallucinations, erethistic debility, and impaired assimilation.

Homatropine has caused dizziness, uncertainty of gait, fatigue, difficulty in deglutition, and loquacious delirium.

Poisoning.—The poisonous actions of belladonna may be summarized as follows:

The skin is dry and hot; the conjunctivæ are congested, with,

possibly, edema of the eyelids and pupils widely dilated; the face is swollen, while the whole body may be covered with an erythematous rash, and there is a sensation of heat and pain in the throat and difficulty in swallowing.

Rapid respirations, muscular weakness, and incoördination of movements appear; the patient becomes dizzy or mildly or violently delirious, continually talking, shouting, or laughing. While there is a constant desire to micturate, there is an inability to pass any urine. At this stage the respirations are slow and shallow. Finally, convulsions may occur, and the patient sink into a comatose condition and die from asphyxia and cardiac exhaustion.

Treatment of Poisoning.—Wash out the stomach with solutions of tannic acid, pursuing the treatment with the cautious administration of physostigmine, opium, or the hypodermic injection of pilocarpine. Should cardiac failure be pronounced or the patient lapse into a state of stupor, stimulants and the subcutaneous injection of caffeine are indicated, the patient being aroused meanwhile and kept awake if possible, respiration being maintained by the use of strychnine and by artificial means when necessary. Should the temperature fall below normal, external heat must be applied.

Atropine compared with Morphine.

Atropine stimulates respiration; morphine is a powerful respiratory depressant. Atropine dilates the pupil; morphine contracts it. Atropine increases bodily heat, and frequently reddens the surface of the skin; morphine produces pallor of the skin and lowers temperature.

Both drugs lessen peristaltic action of the bowels. Atropine reinforces the functional activity of the kidneys; morphine lessens it. On the other hand, atropine checks the secretion from the skin, while morphine increases it.

The remaining secretions are diminished by both drugs, but in different ways. Atropine, for instance, checks secretion by depressing the peripheral terminations of the secretory nerves; morphine, by depressing the secretory center in the medulla.

Both drugs depress the sensory mechanism, yet again by different actions, atropine depressing the function of the sensory nerve-terminations, and morphine depressing the center mainly, although to some extent influencing the entire sensory tract.

Atropine acts rather as a cerebral excitant, producing delirium, hallucinations, and disturbed sleep; morphine is more of a cerebral

depressant, the period of mental excitation being comparatively brief, while sleep is longer and more profound.

In medicinal doses atropine contracts the arterioles; morphine dilates them. Again, while morphine, like atropine, causes the heart to beat faster and stronger, it is by no means so powerful a cardiac stimulant as atropine.

In many respects these drugs are mutually synergistic. Both relieve pain, though morphine is much the more powerful anodyne. Both cause incoördination of muscular movements and mental confusion.

Although in many respects antagonistic, they are frequently combined when an anodyne action is desired. As has been forcibly suggested, their reciprocal influence, when administered together, modifies in a remarkable manner their physiological effects.

Therapeutics.—The many uses for which belladonna has been employed would render it a difficult, perhaps useless, task to enumerate them. As in the case of opium, there are certain general and important actions in disease which the physician can utilize in daily practice, a succinct mention of which is appended:

1. BELLADONNA IS SERVICEABLE IN RELAXING SPASMS OF INVOLUNTARY MUSCLES, as in *asthma*, *spasmodic colic*, *lead colic*, *spasmodic dysmenorrhea*, *laryngismus stridulus*, etc.

2. In DIMINISHING SECRETION, as in *acute coryza*, *bronchitis*, *night-sweats of phthisis*, and to check the *secretion of milk*, *mercurial ptyalism*, etc.

3. In RELIEVING PAIN, either combined with opium or morphine, or alone, particularly where it can be applied locally, as in *lumbago*, *neuralgia*, *pleurodynia*, etc.

4. Belladonna is used to STIMULATE THE CIRCULATORY SYSTEM in cases of a weak heart and low arterial tension, as in *fevers*, etc.

5. FOR ITS PECULIAR ACTION UPON THE EYE IN OPHTHALMOLOGICAL PRACTICE, to dilate the pupil, prevent adhesion, remove congestion, relieve pain, and afford rest.

While, as has been said, it is impossible to mention in detail the manifold uses of belladonna, its more important therapeutic services may be here mentioned:

Externally and Locally.—Belladonna ointment is useful in the treatment of *boils*, *carbuncles*, *chronic inflammatory conditions about the articulations*, *chronic synovitis of the knee-joint*, its efficiency in the latter condition being enhanced by combining it with mercurial

ointment. *Orchitis* is greatly relieved by covering the testicle with belladonna ointment. Suppositories containing extract of belladonna are beneficial in the treatment of *hemorrhoids* and in *anal fissure.* A *rigid os* may be made to dilate, hastening delivery, by smearing the cervix with the ointment of this drug.

Eczema and *excessive sweating* of certain areas of the skin, such as the palms and soles, are benefited by a local application of the tincture or the dried and powdered extract mixed with some inert desiccant powder like powdered talcum.

Belladonna plaster is one of the most useful applications in cases of *acute* or *chronic muscular rheumatism*, and in certain forms of *neuralgia.* In its power to arrest the secretion of milk the drug is perhaps without an equal. Should inflammation have already set in and the breasts be swollen and painful, the ointment is to be applied and the breasts covered with hot flaxseed poultices, the parts being entirely supported by wide bandages.

Internally.—Belladonna is combined with opium to relieve the pain of *gastralgia* and *enteralgia*, while its combination with strychnine and iron is useful in *anemic neuralgia.*

Next to bromoform, it is the most efficient remedy in *whooping cough;* the spasmodic manifestations of *hysteria* are also favorably affected by full doses of tincture of belladonna.

Nocturnal incontinence of urine in children, when resulting from supersensitiveness of the mucous membrane of the bladder, derives signal benefit from this drug. By depressing the ends of the sensory nerves distributed to the bladder belladonna prevents the irritation of the accumulated urine from being conveyed to the center in the cord, and from there reflexly exciting the detrusor muscle of the sphincter and causing micturition.

Belladonna combined with strychnine stimulates the respiration and checks the *sweating in phthisis.* A similar union with some laxative drug makes an exceedingly useful pill in *habitual constipation*, while the *obstinate constipation due to lead-poisoning* is greatly relieved by belladonna.

This drug, as well as the other mydriatic narcotics, is one of the most reliable remedies we possess to relieve the symptoms of *spasmodic asthma.* It is highly recommended also by many physicians in *typhoid fever* to support the circulation and relieve many distressing symptoms of the disease. In *scarlatina*, too, it is thought to be a useful remedy.

Cardiac pain and distress due to over-action of the heart are

alleviated by the application of belladonna plaster over the cardiac region or by the internal use of the drug.

Intestinal, *hepatic*, and *renal colic*, *cystitis*, *prostatitis*, *spermatorrhea*, *exophthalmic goiter*, *cerebral* and *spinal hyperemia*, *sea-sickness*, *facial erysipelas*, and *menorrhagia* have all apparently been favorably influenced by belladonna.

Atropine subcutaneously injected is a powerful antidote to *chloroform-*, *physostigma-*, *aconite-*, and *jaborandi-poisoning*, as well as that contracted from poisonous mushrooms.

Administration.—The crude drug, leaves, and root are seldom if ever used. Owing to its action in diminishing secretion, it is better to time the internal administration of belladonna so as to interfere as little as possible with the process of digestion.

Children are peculiarly insusceptible to this drug, sometimes tolerating as large doses as adults.

When atropine is used hypodermically in cases of sciatica or neuralgia, the injection should be made deeply in close proximity to the affected nerve-trunk.

The part of the body to which a belladonna plaster is to be applied should be first thoroughly cleansed and dried, the exact area to be covered being specifically designated by the physician. Caution should be exercised in the application, lest too large a space be covered by the plaster and dangerous symptoms supervene from absorption of its more active constituents, a result which may also occur from too prolonged contact, from three to five days being usually sufficient. Should it be desirable to continue the influence of the drug, the application of fresh plaster from time to time will produce better results than too long use of a single one.

Stramōnii Fōlia—Stramōnii Foliōrum—Stramonium Leaves. *U. S. P.*

(Thorn-apple; Jamestown or Jimson Weed.)

Origin.—The leaves of *Datura Stramonium* L., a coarse-looking annual weed, believed to be a native of Asia, but found growing in waste places and along roadsides throughout the greater part of the world.

Description and Properties.—From 3 to 8 inches (7–20 Cm.) long, petiolate, dark-green, smooth, ovate, pointed, unequal, especially at the base, coarsely and sinuately toothed; thin, brittle and nearly inodorous; taste unpleasant, bitter and nauseous. Stramo-

nium leaves contain about 0.2 per cent. of a mixture of atropine and hyoscamine known as *daturine.*

Dose.—1–5 grains (0.06–0.3 Gm.).

Stramōnii Sēmen—Stramōnii Sĕminis—Stramonium Seed. *U. S. P.*

Origin.—The seed of *Datura Stramonium* L.

Description and Properties.—About $\frac{1}{8}$ inch (4 Mm.) long, reniform, flattened, pitted and wrinkled, testa dull brownish-black, hard, enclosing a cylindrical, curved embryo imbedded in a whitish, oily perisperm; of an unpleasant odor when bruised, and of an oily and bitter taste.

The seeds contain a larger proportion of daturine than the leaves, besides scopalimine, resin, fixed oil, etc.

Dose.—1–3 grains (0.06–0.2 Gm.).

Official Preparations.

Extrăctum Stramōnii Sĕminis—Extrăcti Stramōnii Sĕminis—Extract of Stramonium Seed.—*Dose*, $\frac{1}{3}$–$\frac{1}{2}$ grain (0.02–0.03 Gm.).

Extrăctum Stramōnii Sĕminis Flūidum—Extrăcti Stramōnii Sĕminis Flūidi—Fluid Extract of Stramonium Seed.—*Dose*, 1–3 minims (0.06–0.2 Cc.).

Tinctūra Stramōnii Sĕminis—Tinctūræ Stramōnii Sĕminis—Tincture of Stramonium Seed (15 per cent.).—*Dose*, 5–10 minims (0.3–0.6 Cc.).

Unguĕntum Stramōnii—Unguĕnti Stramōnii—Stramonium Ointment (10 per cent. of extract).—For external use.

Antagonists and Incompatibles and **Synergists** are the same as for belladonna.

Physiological Action.—The action of stramonium is almost identical with that of belladonna, the main difference being the influence of stramonium upon the sympathetic system, the motor and sensory nerves being less powerfully affected than by belladonna. Stramonium is more apt to occasion irregular action of the heart, and the involuntary muscle-fibers of the bronchial tubes are relaxed more by stramonium than by belladonna. It usually occasions more delirium and is more of an aphrodisiac than belladonna.

Poisoning and *Treatment of Poisoning* are precisely the same as described under Belladonna.

Therapeutics.—The medical uses of belladonna are applicable to this drug, although stramonium is much the better remedy in *spasmodic asthma.* The stramonium ointment appears to be

superior to that prepared from belladonna as an application to *painful hemorrhoids.*

Administration.—No special directions are necessary, any of the preparations being serviceable. For *asthma* the leaves may be smoked in a pipe or in the form of cigarettes, this method of employing the drug to relieve bronchial spasm being probably superior to internal administration.

Hyoscȳamus—Hyoscȳami—Hyoscyamus. *U. S. P.*

(HENBANE.)

Origin.—The leaves and flowering tops of *Hyoscyamus niger* L., collected from plants of the second year's growth. Henbane is a biennial growing in sandy soil and waste places throughout the greater portion of Europe and Asia, and naturalized in North America.

Description and Properties.—Leaves ovate or obovate-oblong, up to 10 inches (25 Cm.) long and 4 inches (10 Cm.) broad; sinuate-toothed, the teeth large, oblong, or triangular; grayish-green, and, particularly on the lower surface, glandular-hairy; midrib prominent; flowers nearly sessile, with an urn-shaped, five-toothed calyx and a light-yellow, purple-veined corolla; odor heavy, narcotic; taste bitter and somewhat acrid.

The active constituents are *hyoscyamine* and *hyoscine*, and a very poisonous volatile oil is obtained by distillation of the leaves, which contain also a small percentage of potassium nitrate.

Dose of the Leaves.—5–15 grains (0.3–1.0 Gm.).

Official Preparations.

Extrăctum Hyoscȳami—Extrăcti Hyoscȳami—Extract of Hyoscyamus.—*Dose*, 1–3 grains (0.06–0.2 Gm.).

Extrăctum Hyoscȳami Flūidum—Extrăcti Hyoscȳami Flūidi—Fluid Extract of Hyoscyamus.—*Dose*, 5–15 minims (0.3–1.0 Cc.).

Tinctūra Hyoscȳami—Tinctūræ Hyoscȳami—Tincture of Hyoscyamus (15 per cent.).—*Dose*, 10–60 minims (0.6–4.0 Cc.).

Hyoscīnæ Hydrobrōmas—Hyoscīnæ Hydrobromātis—Hyoscine Hydrobromate. *U. S. P.*

Origin.—The hydrobromate of an alkaloid obtained from Hyoscyamus.

Description and Properties.—Colorless, transparent, rhombic crystals, odorless, and having an acrid, slightly bitter taste; perma-

nent in the air. Soluble in 1.9 parts of water and in 13 parts of alcohol. It should be kept in small, well-stoppered vials.

Dose.—$\frac{1}{100}$–$\frac{1}{60}$ grain (0.0006–0.001 Gm.).

Hyoscyamīnæ Hydrobrōmas—Hyoscyamīnæ Hydrobromātis — Hyoscyamine Hydrobromate. *U. S. P.*

Origin.—The hydrobromate of an alkaloid obtained from Hyoscyamus.

Description and Properties.—A yellowish-white, amorphous, resin-like mass or prismatic crystals, having, particularly when damp, a tobacco-like odor and an acrid, nauseous, and bitter taste. Deliquescent on exposure to the air; soluble in about 0.3 part of water and 2 parts of alcohol. It should be kept in small, well-stoppered vials.

Dose.—$\frac{1}{100}$–$\frac{1}{40}$ grain (0.0006–0.0015 Gm.).

Hyoscyamīnæ Sŭlphas—Hyoscyamīnæ Sulphātis —Hyoscyamine Sulphate. *U. S. P.*

Origin.—The neutral sulphate of an alkaloid obtained from Hyoscyamus.

Description and Properties.—White, indistinct crystals or a white powder, without odor, and of a bitter, acrid taste; deliquescent in damp air. Soluble in 0.5 part of water and 2.5 parts of alcohol. It should be kept in small, well-stoppered bottles.

Dose.—$\frac{1}{100}$–$\frac{1}{40}$ grain (0.0006–0.0015 Gm.).

Antagonists, Incompatibles, and **Synergists** the same as for belladonna.

Physiological Action.—The action of hyoscyamus is analogous to that of belladonna, with the following differences:

1. Hyoscyamus does not depress the peristaltic action of the intestines as much as belladonna, but is more efficient in relieving the griping and pain occasioned by the rougher cathartics.

2. It is less powerful than belladonna as a cardiac stimulant, though stronger than stramonium.

3. It does not occasion nearly so much mental excitement as belladonna, on account of the hyoscine it contains, which is a powerful hypnotic and cerebral and spinal sedative.

4. As a urinary sedative hyoscyamus is greatly superior to belladonna.

5. It differs from belladonna in affecting the respiration less powerfully.

Untoward Action, *Poisoning*, and *Treatment of Poisoning* are the same as for belladonna.

Therapeutics.—HYOSCYAMUS may be used for the same purposes as belladonna, but is considered superior to the latter drug as a urinary sedative in the treatment of *incontinence of urine*, *vesical tenesmus*, *cystitis*, *prostatitis*, etc.

For the relief of *colic of various forms*, and to *allay the griping* produced by certain purgatives, hyoscyamus is better than belladonna.

In mental and convulsive diseases, such as *delusional insanity*, *delirium tremens*, *acute and febrile mania*, *insomnia*, *chronic dementia*, *hysterical convulsions*, *chorea*, *paralysis agitans*, etc., hyoscyamus, particularly HYOSCINE, is superior to belladonna.

Hyoscyamus and its alkaloids are fully equal to belladonna in the treatment of *asthma*, *whooping cough*, *neuralgia*, *enteralgia*, etc.

As an anodyne and hypnotic for children hyoscyamus is safer than, and frequently as efficient as, opium.

Contraindications.—The same as for belladonna.

Administration.—Like belladonna, this drug should be administered tentatively. Any of the preparations may be given. The salts of the alkaloids may be administered either subcutaneously or internally.

The hyoscine is tasteless, and may be easily given in various drinks. When used internally its action is slower, but more prolonged, than when given hypodermically, though the dose under the former method should be twice that of the latter.

GROUP VI.—MOTOR EXCITANTS.

THE drugs belonging to this group excite the functional activity of the spinal cord and the sympathetic nervous system. They serve to stimulate muscular contraction and the functional operations of the heart, lungs, and secretory apparatus.

It is difficult to separate by sharply-defined limits the remedies having these actions, and group them according to their analogous therapeutic uses.

In the present group, for instance, are placed ergot and gossypium, chiefly used for their action upon the uterus, while those drugs which, although excito-motors, are employed principally for their action upon the circulatory system are placed in the group, *Cardiac Stimulants.*

The motor excitants are exceedingly valuable remedies, the typical member of the group being Nux Vomica, and therefore first considered.

Nŭx Vŏmica—Nūcis Vŏmicæ—Nux Vomica. *U. S. P.*

Origin.—The seeds of *Strychnos Nux Vomica* L., a small tree common in many parts of Hindustan, Farther India, some of the East Indies, and in some parts of Australia.

Description and Properties.—Nux vomica is about 1 inch (25 Mm.) in diameter, orbicular, grayish or greenish-gray; soft-hairy, of a silky luster, with a slight ridge extending from the center of one side to the edge; internally horny, somewhat translucent, very tough, with a large circular cavity, into which the heart-shaped, nerved cotyledons project. It is inodorous and persistently bitter.

Nux vomica contains two important alkaloids—*strychnine* and *brucine*, the former being in excess. The seeds also contain igasuric acid, with which these alkaloids are combined. Of total alkaloids the drug should contain from 2.5 to 5 per cent.

Dose.—1–5 grains (0.06–0.3 Gm.).

Official Preparations.

Extrăctum Nūcis Vŏmicæ—Extrăcti Nūcis Vŏmicæ—Extract of Nux Vomica.—*Dose*, ⅛–½ grain (0.008–0.03 Gm.).

Extrăctum Nūcis Vŏmicæ Flūidum—Extrăcti Nūcis Vŏmicæ Flūidi—Fluid Extract of Nux Vomica.—*Dose*, 1–5 minims (0.06–0.3 Cc.).

Tinctūra Nūcis Vŏmicæ—Tinctūræ Nūcis Vŏmicæ—Tincture of Nux Vomica.—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Strychnīna—Strychnīnæ—Strychnine. *U. S. P.*

Origin.—An alkaloid obtained from Nux Vomica, and also derived from other plants of the natural order *Loganiaceæ.*

Description and Properties.—Colorless, transparent, octahedral or prismatic crystals, or a white, crystalline powder, odorless and having an intensely bitter taste, perceptible even in highly dilute (1 to 700,000) solution. Permanent in the air. Soluble at 15° C.

(59° F.) in 6700 parts of water, in 110 parts of alcohol, in 2500 parts of boiling water, and in 12 parts of boiling alcohol; also soluble in 7 parts of chloroform, but almost insoluble in ether.

Dose.—$\frac{1}{64}$–$\frac{1}{16}$ grain (0.001–0.004 Gm.).

Strychnine enters into the following preparations:

Fĕrri et Strychnīnæ Cĭtras.

Sўrupus Fĕrri, Quinīnæ et Strychnīnæ Phosphātum. (See *Ferrum*, page 185.)

Strychnīnæ Sŭlphas—Strychnīnæ Sŭlphātis—Strychnine Sulphate. *U. S. P.*

Description and Properties.—Colorless or white, prismatic crystals, odorless, and having an intensely bitter taste, perceptible even in highly dilute (1 in 700,000) solution. Efflorescent in dry air. Soluble at 15° C. (59° F.) in 50 parts of water and in 109 parts of alcohol; also soluble in 2 parts of boiling water and 8.5 parts of boiling alcohol. Almost insoluble in ether.

Dose.—$\frac{1}{64}$–$\frac{1}{16}$ grain (0.001–0.004 Gm.).

Antagonists and Incompatibles.—Chloral, tobacco, potassium bromide, chloroform, and ether antagonize the toxic action of strychnine, the first-named drug being the best antagonist. Physostigma, curare, conium, opium, hydrastine, and oil of chamomile are also antagonistic.

The incompatibles are tannic acid, bromides, iodides, and chlorides.

Synergists.—The motor excitants, ergot, ustilago, electricity, and cold.

Physiological Action.—Since strychnine fully represents the physiological action of nux vomica, that of the former is here given.

Externally and Locally.—In large doses strychnine acts as an antiseptic, but on account of its poisonous nature it is too dangerous to be serviceable. When applied locally to unicellular organisms, in very dilute solutions, the drug acts as a stimulant, increasing their movements. In slightly more concentrated solutions strychnine arrests these movements and destroys life.

Internally.—Digestive System.—Strychnine is an excellent stomachic tonic, improving the appetite greatly and aiding digestion. By its favorable action upon the mucous membrane of the stomach it facilitates the secretion of gastric juice, and by

imparting tone to the muscular walls of the intestines it increases peristalsis and allays constipation when due to lack of muscular tone.

Probably the favorable action which strychnine exerts on the stomach is due to its stimulation of the nerve centers which preside over the blood-supply and the secretory cells, thus rendering the digestive process more perfect.

Circulatory System.—Strychnine stimulates the heart by its action on the cardiac muscle. Pharmacologically the pulse should

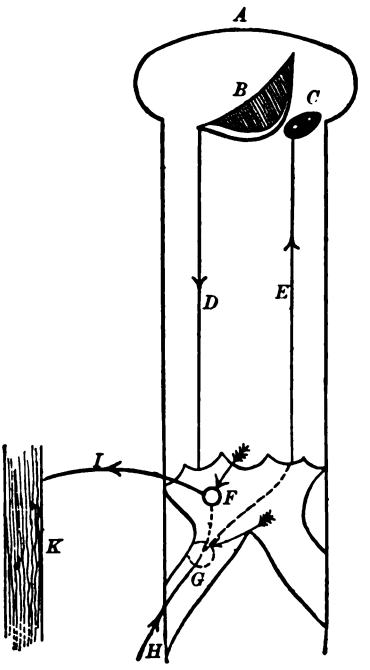

FIG. 5.—Diagram showing how strychnine affects the motor and reflex mechanisms: *A*, motor and sensory mechanisms; *B*, cerebral motor areas; *C*, sensory center; *D*, motor tract; *E*, sensory tract; *F*, spinal *motor areas; G, switch center*, or mechanism for conveying impressions from sensory to motor nerves; *H*, sensory nerve; *I*, motor nerve; *K*, muscle.

be decreased, owing to the stimulating action of the vagus center in the medulla. But this depressing influence seems to be overcome by the direct stimulating action upon the heart muscle. In therapeutic doses it is generally held that the pulse is slightly increased. In poisonous doses the pulse is slowed and weakened, owing to over-stimulation of both the heart muscle and the motor mechanism.

Nervous System.—Strychnine enormously increases the excita-

bility of the central nervous axis. The first symptoms of the drug are an increase in all the reflexes. This has been shown by Holton and Muirhead to be due to a diminished resistance between the cells in the anterior and posterior horns of the cord. Normally, stimulation of a certain part—as, for instance, of a frog's toe—simply occasions a movement of the part stimulated, no other point being affected. But under the influence of strychnine the slightest stimulation is often sufficient to throw the whole body into tetanic contraction, showing that not only is the resistance in the normal path followed by lessened reflexes, but that resistance in all directions is diminished to such an extent that the impulse affects the entire muscular system. This action on the reflexes is principally on the cord. In fact, the action of strychnine upon the cord seems to be more powerful than upon any other portion of the central nervous axis. That the upper brain centers also are stimulated is shown by the fact that all mental processes are rendered more acute; and the same is true of special senses. Very large doses of strychnine cause paralysis of the motor apparatus, with loss of voluntary movement—due to over-stimulation of the reflex centers in the cord, producing exhaustion.

It must be remembered that strychnine does not increase the automatic powers, but simply augments their susceptibility to external stimulation.

Strychnine greatly intensifies reflex excitability, so that in strychnine-poisoning a bright light, a sound, a jar of the bed, or touching the skin may reflexly produce a convulsive seizure.

Respiratory System.—By the stimulating effect of strychnine upon the respiratory center in the medulla the breathing is rendered quicker and deeper. Owing to the tetanic contractions of the respiratory muscles, under poisonous doses the breathing is greatly interrupted, and the patient may become asphyxiated. At length, the respiratory muscles becoming completely exhausted, death ensues, although the principal cause of collapse is paralysis of the respiratory centre. It is to be noted that the heart continues to beat for some time after respiration has ceased.

Absorption and Elimination.—Strychnine is rapidly absorbed and slowly excreted, and consequently accumulates in the system. It is eliminated mainly by the kidneys, appearing in the urine as strychnine, and is also slightly excreted by the skin and the salivary glands.

PLATE I.

Strychnine-poisoning.

Temperature.—Under therapeutic doses the temperature is slightly raised, owing to increased oxidation, as shown by the increase of urea and carbon dioxide eliminated and of oxygen taken in. During the tetanic convulsions the body temperature is markedly raised, though it is generally greatly reduced during the stage of exhaustion immediately preceding death.

Eye.—The general nervous stimulation produced by strychnine affects the mechanism of the eye, vision, as has been remarked, being rendered more acute.

Uterus.—Strychnine exerts some influence upon the muscular uterine tissues and assists the catamenia.

Untoward Action.—Certain peculiar manifestations, having but slight resemblance, or none whatever, to the characteristic symptoms of poisoning, have followed the ingestion of small doses of strychnine. Some observers have noted the presence of a scarlatiniform eruption; cramps followed by perspiration, resembling in some respects the tertian type of intermittent fever; redness of the eyes; formication; a peculiar heaviness and stiffness of the limbs; persistent and painful priapism; and gastric uneasiness.

Children are exceedingly susceptible to the untoward effects of strychnine, its administration requiring extreme caution. The author, however, is familiar with a case resulting beneficially in the practice of Dr. Alfred C. Cotton of Chicago, when $\frac{1}{16}$ grain (0.036 Gm.) of strychnine sulphate was given hypodermically every three hours to a child three years of age seriously ill with pneumonia. Such heroic dosage is nevertheless seldom advisable.

Poisoning.—As is the case with other active poisons, strychnine in lethal doses produces varying effects dependent upon temperament, idiosyncrasy, and physiological conditions. Generally speaking, the absorption of large doses is followed by rigidity of the lower maxillary, dilatation of the pupils, increased action of the reflexes, and spasmodic and distressing muscular contraction, affecting the extensors particularly. Finally, the respiratory muscles are affected with tetanic rigidity, death resulting from asphyxia. In many cases the earliest symptoms of poisoning are restlessness and anxiety, twitching of the muscles, and stiffness of the neck. Spinal convulsions are manifested, the patient assuming the position of opisthotonos, so that he rests upon his head and his heels.

The slightest external irritation at this stage, even a movement of the bed-clothes, is sufficient to cause a recurrence of convulsions. Notwithstanding these grave symptoms, the mind remains unaf-

fected until carbonic-acid poisoning sets in, and the stomach is usually retentive. Accompanying the usual symptoms in cases of acute poisoning is the distortion of the features, which assume a ghastly grin (*risus sardonicus*). The action upon the genito-urinary tract is quite marked, involuntary ejaculations of semen frequently taking place, together with incontinence of urine.

The earlier paroxysms attendant upon the effects of the drug are seldom fatal, but in the intervals of repose the patient's mind is oppressed with a sense of impending dissolution, intensified by each renewed access of spasm and increasing severity of pain.

Treatment of Poisoning.—Emetics and cleansing of the stomach are naturally of the first importance. Animal charcoal and tannic acid should be freely administered, while copious anal injections containing potassium bromide and chloral are often efficacious in relieving the spasms.

Amyl-nitrite inhalations may prove serviceable as an aid to restore failing respiration when artificial means are required.

The chemical antidote to strychnine is tannin, which should be given immediately in the form of an aqueous solution, the stomach being subsequently well cleansed. Catheterism should be performed frequently to favor elimination, care being taken not to create a recurrence of spasm and consequent convulsions, which may often be obviated by the inhalation of chloroform or ether in sufficient quantities to produce complete anesthesia. The bowels should be evacuated, croton oil *per rectum* being an efficient agent.

As has been stated, potassium bromide, chloral, and physostigmine are serviceable physiological antidotes. Opium and conium may also be used to counteract the effects of the drug. Paraldehyde has been preferred to chloral, and tobacco and alcohol have been suggested, even in heroic doses, should the malady refuse to yield to other remedial agents.

Therapeutics.—*Externally and Locally.*—M. Mackenzie has recommended strychnine in $\frac{1}{24}$—$\frac{1}{16}$ grain (0.0027–0.004 Gm.) doses in some harmless and inert medium as an insufflation in *anosmia*, and lint saturated with the tincture of nux vomica and applied to the perineum has been advised in *incontinence of urine*.

Internally.—There is no more efficient remedy in *atonic dyspepsia* than nux vomica or strychnine. Both possess all the properties of the simple bitters, besides stimulating the nerve-centers, rendering the co-ordination of the digestive process more perfect

and enabling the stomach to respond more readily when the stimulus of food is applied to it.

The *gastric catarrh* of inebriates is especially benefited by this drug, which also serves a useful purpose in the *vomiting of pregnancy* and *of phthisis.*

Its tonic action upon the intestinal muscles renders it an invaluable remedy in *habitual constipation*, *atonic diarrhea*, and *prolapsus of the rectum*, the latter condition being frequently observed in children and aged persons, especially the latter, who are often mentally depressed by this infirmity, and who are relieved by strychnine, either given internally or injected as a solution into the subcutaneous tissue of the rectum, toning up the muscles and at the same time stimulating the cerebrum, relieving the melancholia and inspiring the patient with hope.

Strychnine is a most valuable cardiac tonic, having a marked action on the cardiac nervous system and also upon the heart muscle. In *pneumonia*, *typhoid fever*, and other diseases accompanied by dyspnea and feeble heart-action, no more valuable drug can be employed. It differs from alcohol and other cardiac stimulants in that its use is not followed by depression. The hypodermic injection of full doses of strychnine ordinarily renders the pulse full and strong, even when it is scarcely perceptible and death appears imminent. Many clinicians have undoubtedly tided pneumonic patients over the critical period by the heroic use of strychnine, when, but for the drug, they would have died. The *functional irregularity of the heart's action* accompanying *hysteria*, *hypochondriasis*, and *pregnancy* is greatly relieved by moderate doses of tincture of nux vomica.

As a tonic in *chlorosis* and *anemia* strychnine is an esteemed remedy, being, in the author's opinion, the best we possess in general efficiency. It improves the appetite, prevents putrefactive changes, and aids digestion, thereby enabling the patient to partake of and assimilate more nutriment. It also increases the force of the heart, quickens the circulation, and raises arterial tension, nourishing all parts of the body and rendering the condition more favorable for oxidation in the tissues and for the removal of waste products. The amount of urine is increased, constipation is relieved, and thus elimination of these products facilitated.

Oxidation is further enhanced by the increased respiratory movements, rendering the blood richer in oxygen and increasing the number of the red corpuscles.

The potent action of strychnine upon the nervous system stimulates the spinal cord, giving the patient greater strength, and, by invigorating the brain, animating him with cheerfulness and confidence and a disposal to exercise.

Strychnine, then, is at once a gastric, vascular, nervous, muscular, and respiratory tonic, being an invaluable remedy in debility from any cause.

In *bronchial* and *neurotic asthma*, as well as in many forms of *neuralgia*, particularly the visceral variety, the drug is an efficient remedy. In *bronchitis* also, and to relieve the *coughs* of neurotic origin, it is of great value.

Paralysis of spinal origin—*paraplegia*, etc.—and *hemiplegia* previous to degeneration, with complete relaxation of the muscles, are benefited by strychnine, although in the latter affection it is of little if any value in recent cases or when the muscles do not respond to the electric current.

The sphincters of the body, although belonging to the unstriped muscles, are more or less under the control of the will; still, when there is an atonic condition of these structures, as in *incontinence of urine*, due to weakness of the sphincter, strychnine is a very powerful remedy. For the same remedial properties it is equally valuable in *retention of urine* when the detrusor muscle is too weak to empty the bladder.

Probably no other drug equals strychnine in *diphtheritic paralysis*, the form of the disease most benefited by the remedy. It is of use, however, in all varieties of *functional paralysis*, such as those resulting from hysteria, mental emotion, alcoholism, venereal excesses, the abuse of opium, lead-poisoning, gout, rheumatism, concussion of the spinal marrow, etc.

Jewell claims that strychnine has caused an improvement in *myelitis* after the failure of other remedies.

The weak and semi-paralyitic condition sometimes induced by bromides is improved by strychnine.

The drug has found a few supporters in the treatment of *tetanus*, *epilepsy*, *tic douloureux*, and *chorea*, though it has not been generally adopted as a remedy in these diseases.

Strychnine is exceedingly efficacious in *amaurosis* due to excessive use of alcohol or tobacco, being also valuable in *paresis of the ocular muscles*. *Night-blindness* is also greatly benefited by this drug.

It is of undoubted merit in *delirium tremens*, as well as in pre-

venting the usual effects of alcoholic intoxication; in fact, the drug is one of the best remedies in the treatment of *alcoholism*, the strychnine nitrate being usually employed, hypodermically. According to the best authorities on dipsomania, strychnine seems to be a true antagonist to the untoward action of alcohol, and it is probably the important constituent of the numerous "cures" for the alcohol habit.

No less valuable is strychnine in the treatment of acute *poisoning* by *chloral*, *morphine*, and *physostigmine*.

As an aphrodisiac it is of unquestioned value in *functional spermatorrhea*, and it is thought to produce contractions of the gravid uterus and cause *abortion* or *premature delivery*. When a predisposition to *post-partum hemorrhage* exists, the administration of strychnine may prove of great service.

Finally, strychnine has been highly recommended in the *night-sweats of phthisis* and in *diabetes mellitus*.

Contraindications.—Strychnine is contraindicated in acute inflammatory conditions of the spinal cord and excessive reflex irritability.

Administration.—The extract of nux vomica, the tincture, the fluid extract, or the alkaloid strychnine may be given and gradually increased, a tolerance by the system being rapidly established. The salts of strychnine are preferable to other preparations, the crude drug and its preparations varying greatly in strength, 10 minims (0.6 Cc.) of one tincture sometimes containing as large a percentage of strychnine as 20 minims (1.2 Cc.) of another.

The drug should be cautiously administered to children, the initial dose for a child five or six years of age not exceeding $\frac{1}{100}$ grain (0.0006 Gm.).

In using strychnine hypodermically the soluble hypodermic tablets should be freshly dissolved in distilled water.

The solutions of strychnine and of the other alkaloids should not be kept in stock, as they become contaminated with microscopic plants.

Cŏcculus—Cŏcculi—Cocculus Indicus.

(Fish Berry.)

Origin.—The dried fruit of *Anamirta Cocculus* Wright and Arnott, a climbing shrub in Eastern India, native to the Malabar coast.

Description and Properties.—A globular, kidney-shaped, one-celled berry, about $\frac{1}{4}$ inch (6 Mm.) in diameter and $\frac{2}{5}$ inch (10 Mm.) in length, blackish-brown and wrinkled. The seed is very bitter, but the pericarp is tasteless. The chief constituent is *picrotoxin*, the poisonous principle contained in the kernel and first isolated by Boullay in 1819.

The crude drug is not used internally.

Unofficial Preparations.

Tinctūra Cŏcculi—Tinctūræ Cŏcculi—Tincture of Cocculus.—*Dose*, 2–20 minims (0.12–1.2 Cc.).

Extrăctum Cŏcculi Flūidum—Extrăcti Cŏcculi Flūidi—Fluid Extract of Cocculus.—*Dose*, 1–3 minims (0.06–0.2 Cc.).

Picrotŏxinum—Picrotŏxini—Picrotoxin. *U. S. P.*

Origin.—A neutral principle obtained from the seed of *Anamirta paniculata* Colebrooke.

Description and Properties.—Colorless, flexible, shining, prismatic crystals, or a micro-crystalline powder, odorless and having a very bitter taste; permanent in the air. Soluble in 240 parts of water and in 9 parts of alcohol.

Dose.—$\frac{1}{64}$–$\frac{1}{32}$ grain (0.001–0.002 Gm.).

Antagonists and Incompatibles.—Chloral, the motor depressants, acetic acid, and the anesthetics antagonize the effects of picrotoxin.

Synergists.—All the motor excitants.

Physiological Action.—*Externally and Locally.*—It is a powerful parasiticide, being very destructive to lower forms of animal life.

Internally.—Digestive System.—In small medicinal doses its action is similar to that of strychnine.

Circulatory System.—Its general effects do not differ essentially from those of strychnine.

Nervous System.—Picrotoxin differs somewhat from strychnine in its action upon the nervous system, poisonous doses producing epileptiform convulsions and spasms of the flexor muscles, alternating from tonic to clonic, whereas the spasms induced by strychnine affect principally the extensor muscles and are tonic in character. The brain also is differently affected—toxic doses resulting in stupor, delirium, coma, and complete insensibility.

Respiratory System.—Picrotoxin tends to stimulate the respiratory center, its general influence being analogous to that of strychnine.

Absorption and Elimination.—The drug is rapidly absorbed, and, as in the case of strychnine, is eliminated chiefly by the kidneys, the sweat being also a channel of excretion, since cocculus, even more than strychnine, acts as a powerful diaphoretic.

Temperature.—No special action has been noted, though the temperature may be raised slightly during the convulsive period.

Eye.—The pupils are dilated during the tonic and contracted during the clonic spasms. An ophthalmoscopic examination shows a marked hyperemia of the ocular fundus.

Poisoning.—The drug produces muscular twitchings, incoördination, great restlessness, tonic convulsions, with opisthotonos or emprosthotonos, alternating with clonic spasms and succeeded by paralysis, delirium, and coma. The respiratory apparatus is affected as in strychnine-poisoning, the symptoms being very similar to those of an epileptic seizure.

Treatment of Poisoning.—This is identical with that prescribed in cases of poisoning by strychnine.

Therapeutics.—*Externally and Locally.*—The most important use of COCCULUS locally is in the treatment of *parasitic* and *skin diseases*, an ointment of picrotoxin—10 grains to 1 ounce (0.6–32.0 Gm.)—being employed for this purpose. Caution should be used in applying it to abraded surfaces lest poisoning result.

The DECOCTION or TINCTURE of cocculus Indicus is very effective in destroying parasitic vermin infesting the head and body.

Internally.—PICROTOXIN has been used, although less successfully, for many diseases treated with strychnine, especially paralysis of the extremities and of the sphincters.

Planat has highly recommended the use of cocculus in *epilepsy;* the best results in this disease, however, are obtained in the treatment of the nocturnal variety. The same authority advised the employment of the drug in *chorea*, *infantile eclampsia*, and *chronic spasm of the limbs.*

Bartholow suggested that the drug, like strychnine, would prove valuable in *intestinal torpor.*

Bókai has advocated its use in *opium-poisoning.*

Unquestionably, its most valuable action is in controlling the *night-sweats of phthisis.* Mirrell, who first used it for this purpose, reported but one failure in twenty. Gubler has succeeded in greatly benefiting *glosso-labio-laryngeal paralysis* by the hypodermic injection of $\frac{1}{64}$ grain (0.001 Gm.) of picrotoxin.

Dysmenorrhea and *migraine* occurring at the menstrual period are said to be greatly relieved by this drug. Even sero-purulent *leucorrhea*, it is claimed, has derived benefit from the administration of some preparation of cocculus.

Contraindications.—Similar to those for strychnine.

Administration.—The picrotoxin is far preferable to other preparations of cocculus, both for external and internal use. It should be very cautiously administered, however.

Ergōta—Ergōtæ—Ergot. *U. S. P.*

(Ergot of Rye.)

Origin.—The sclerotium of *Claviceps purpurea* (Fries) Tulasne (Fungi), replacing the grain of rye, *Secale cereale* L. Most of the commercial article comes from Spain and Russia.

Description and Properties.—Somewhat fusiform, obtusely triangular, usually curved, about ¾ to 1¼ inches (2–3 Cm.) long and ⅛ inch (3 Mm.) thick; three-furrowed, obtuse at both ends, purplish-black, internally whitish, with some purplish striæ, breaking with a short fracture; odor peculiar, heavy, increased by trituration with potassium or sodium hydrate T. S.; taste oily and disagreeable. Old ergot, which breaks with a sharp snap, is almost or entirely devoid of a pinkish tinge in the fracture, is hard and brittle between the teeth, and comparatively odorless and tasteless—should be rejected.

Ergot should be but moderately dried and preserved in a close vessel, with a few drops of chloroform added from time to time to prevent the development of insects. When more than one year old it is unfit for use.

The active constituents of ergot are not definitely ascertained. It contains, however, an acid soluble in water and variously termed *sclerotinic*, *ergotinic*, and *ergotic* acid, and another, soluble in alkalies, known as *sphacelic* acid. Both of these acids possess ecbolic properties. Ergot also contains a principle known as *cornutin*, and 30 per cent. of a yellow non-drying saponifiable fixed oil, besides proteids, sugar, tannin, and ash. The commercial ergotin is merely a purified aqueous extract of ergot.

Dose.—5–60 grains (0.30–4.0 Gm.).

Official Preparations.

Extractum Ergōtæ—Extracti Ergōtæ—Extract of Ergot.—*Dose*, 2–10 grains (0.12–0.06 Gm.).

Extrăctum Ergōtæ Flŭidum—Extrăcti Ergōtæ Flŭidi—Flŭid Extract of Ergot.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Vīnum Ergōtæ—Vīni Ergōtæ—Wine of Ergot.—*Dose*, 1–3 fluidrachms (4.0–12.0 Cc.).

Unofficial Preparations.

Tinctūra Ergōtæ—Tinctūræ Ergōtæ—Tincture of Ergot.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Ergotin (Bonjean's).—*Dose*, 2–8 grains (0.012–0.5 Gm.).

Antagonists and Incompatibles.—The cardiac and motor depressants antagonize the action of ergot. Caustic alkalies and metallic salts are chemically incompatible.

Synergists.—Its action upon the circulation is aided by digitalis and belladonna; upon the nervous system by strychnine; while ustilago, hydrastine, gossypium, and the emmenagogues enhance its influence upon the uterus.

Physiological Action.—*Externally and Locally.*—Ergot has no distinctive action upon the skin, but upon mucous membranes its influence is that of an astringent, possessing hemostatic properties.

Internally.—Digestive System.—In large doses it is a gastro-intestinal irritant, occasioning considerable heat and dryness of the throat, accompanied by thirst and succeeded by pain in the stomach and bowels, vomiting, and occasionally purging, with violent peristalsis, although constipation is the commoner sequence.

Circulatory System.—Repeated medicinal doses increase the blood-pressure, although rendering the pulse slower and smaller—the result primarily of stimulation of the vaso-motor center, followed by peripheral action, causing a tonic contraction of the small unstriped muscle fibers.

A poisonous dose lowers arterial tension, causing the pulse to beat faster and softer—an effect due to exhaustion from over-stimulation or to direct depressant action upon the heart-muscle. It is claimed by competent authority that there is no active and actual contraction of the arteries, the result of stimulation of the vaso-motor system, but that the arteries contract because of the fulness of the veins, there not being sufficient blood to fill both systems, marked arterial anemia consequently resulting. It must be admitted that the true physiological action upon the circulatory system is not yet generally understood, being still *sub judice*, since equally competent pharmacologists maintain that the arterial pressure is increased as explained above.

It is an undisputed fact, however, that the cardiac muscle is

actually contracted by ergot. Indeed, Willebrand claims that "the normal or hypertrophied heart so contracts under the action of ergot that the difference in size is appreciable by percussion" (Bartholow).

If any changes are produced by this drug in the composition of the blood, they have not been ascertained.

Nervous System.—Medicinal doses have no especial action, though excessive doses sometimes depress the sensory mechanism, producing general cutaneous anesthesia.

The action of toxic doses on the nervous system will be described under "Poisoning."

Respiratory System.—Medicinal doses produce no particular effect. Large doses depress the respiratory center, rendering the breathing shallow. This action is manifest from the first, there being no primary stimulation of the respiration. Death from an overdose of ergot usually results from paralysis of the respiratory center.

Absorption and Elimination.—The active constituents of ergot are rapidly absorbed into the blood, and are eliminated principally by the kidneys, increasing the urinary flow.

Temperature.—No special action has been observed.

Eye.—The caliber of the retinal and nutrient opticus blood-vessels is reduced, resulting in marked pallor of the disk, transitory amblyopia, and papillary anemia.

Uterus.—Probably the most important action of ergot is upon this organ. It produces in full doses tetanic, tonic contraction of the uterine muscle, the uterus becoming hard and pale, and forcing the blood out of the uterine arterioles. The organ is more sensitive to the action of the drug during pregnancy.

The precise manner in which ergot affects the uterus is still a matter of discussion. It is fairly demonstrated, however, that the drug acts both centrally and peripherally, owing to its different constituents, cornutin acting centrally and sclerotinic acid peripherally. The drug causes a contraction of involuntary muscles throughout the body.

It is doubtful if any drug in our Materia Medica has been more carefully studied than ergot, and, if opinions differ widely as to its *modus operandi*, it is because we have to deal with a very complex substance, the nature, and even the number, of whose constituents are as yet inadequately known. Many principles of the drug are unstable and variable in their action, certain preparations differing decidedly from others in their influence, as, for instance, Tanret's ergotinine, which has no effect upon the uterus. Bonjean's ergotin

is a powerful ecbolic, and has a marked action, moreover, upon the vascular system, whereas Wigger's ergotin is inert.

Untoward Action.—In addition to the gastro-intestinal disturbances already described, there are occasionally produced headache, mental confusion, dizziness, a feeling of chilliness, muscular weakness, dilatation of pupils, and glimmering before the eyes.

Poisoning.—There are two varieties of ergot-poisoning, acute and chronic. Under the administration of immoderate doses peculiar symptoms appear, known collectively as *acute ergotism.* Restlessness, mental worry, headache, tinnitus aurium, dilatation of the pupils, pallor and coldness of the skin, and other effects are present. At times cutaneous anesthesia is manifest or general formication. Epileptiform spasms, great reduction of respiration and temperature, may occur, while obstruction of cardiac movements, with sudden nausea and violent vomiting, and other alarming manifestations, attest the untoward properties of the drug.

Chronic ergotism is confined chiefly to Europe, where ergotized rye is used in bread-making. The disease is marked by convulsive or gangrenous conditions.

The first variety, the convulsive, is characterized by paroxysmal spasms of the flexor muscles, which later become continuous, resulting in opisthotonos or emprosthotonos. There is dimness of vision, while an increasing intensity of symptoms develops affection of other special senses, those of hearing and smell being either impaired or temporarily lost. Violent abdominal cramps also occur, together with painful dyspnea, death resulting from asphyxia or coma.

The second (gangrenous) form is signalized by severity of local phenomena, profound dyscrasia, formication or cutaneous anesthesia, impairment of special senses, and numbness of the muscles or extremities, followed by sloughing or atrophy of the diseased parts and mummification or dry or moist gangrene.

Fatal results of chronic ergotism are usually traceable to the convulsions, although moist or dry gangrene may in certain cases produce death.

A form of ergotism is peculiar to Lombardy, Italy, occasioned by chronic poisoning with diseased or fermented maize, and affecting principally the cerebro-spinal and digestive systems. It causes an acute erythema, which extends rapidly and is attended with much swelling, together with an extreme sensation of burning or itching. Pronounced nervous and general symptoms are present, and the malady not infrequently results in insanity or melancholia.

Treatment of Poisoning.—Symptoms of acute poisoning may be

alleviated by hot baths and the administration of tannic acid and cardiac stimulants. For the treatment of chronic ergotism hygienic measures and symptomatic remedies are indicated.

Therapeutics.—*Externally and Locally.*—In the form of lozenges or diluted FLUID EXTRACT the drug has been employed in *acute pharyngitis.* The hypodermic injections of ERGOTIN are valuable in *nasal hypertrophies, prolapsus of the rectum, hemorrhoids, enlargement of the prostate gland, aneurysm, varicocele,* and *varicose veins.*

Internally.—The most important medical use of ERGOT is to promote uterine contractions in labor. The preponderance of testimony among the most experienced obstetricians is in favor of its use only after the expulsion of the uterine contents. This is a rule, however, which cannot be invariably followed. While the employment of the drug is contraindicated in the *first stage* of labor, it may be safely employed during the second stage, when there is uterine inertia, provided all the parts be in a normal condition and there exists no mechanical impediment to the rapid delivery of the child. Ergot is of service also when the placenta is retained owing to inefficient and feeble uterine contractions.

With these exceptions it is customary—and the author concurs in the procedure—to delay the administration of the drug until the expulsion of the placenta, when a full dose of the fluid extract is given, or ergotin hypodermically. When ergot is administered during the second stage of labor, it should be given in small doses, so as to promote intermittent rather than continuous contractions of the uterus. No drug possesses so energetic and prompt an action as ergot in *post-partum* and *uterine hemorrhage.* It is an exceedingly efficacious remedy also in *subinvolution* and in *uterine fibroids* and *polypi.*

The accompanying diagrams will illustrate the control of hemorrhage through the contraction of the uterine muscle and arterioles, and the influence of ergot upon submucous fibroid tumors by mechanical compression and consequent diminution of their blood-supply. It is obvious that the location of a subperitoneal tumor is such that the drug cannot influence its growth as it can a submucous fibroid.

This remedy is also extremely useful in the treatment of *plethoric amenorrhea, congestive dysmenorrhea, menorrhagia, chronic metritis,* etc.

DILATATION OF THE CARDIAC CAVITIES without valvular lesion is much improved by the administration of ergot; the remedy has

also been employed with considerable success in *chronic diarrhea* and *dysentery.*

Incontinence of urine—depending either upon enlarged prostate, irritability, or a paretic or paralytic condition of the bladder—is

FIG. 6.—Diagram showing how ergot reduces uterine hemorrhage: *A*, uterine muscle; *B*, *B*, arteries.

FIG. 7.—Diagram showing how ergot reduces the size of a submucous fibroid, but has no effect upon a subperitoneal fibroid: *A*, uterine muscle; *B*, subperitoneal fibroid; *C*, submucous fibroid; *D*, *D*, arteries.

greatly relieved by this remedy. The atonic form of *spermatorrhea* is palliated or cured by ergot.

The drug is of value also in *cerebral hyperemia* and consequent *mania*, as well as in *cerebro-spinal meningitis, congestion of the spine, myelitis*, and *congestive headaches.*

Ergot has been highly recommended, notably by Dr. J. M. Da Costa, in *diabetes insipidus*, and by such authorities as Heltzmann and D'Enslow in *prurigo, erythema, urticaria*, and *acne rosacea.*

Owing to the peculiar action of ergot upon unstriped muscular fiber it is a valuable drug in various forms of *hemorrhage.*

The diseases mentioned as being favorably influenced by the local application yield as readily perhaps to the internal administration of ergot.

Finally, this remedy has met with some success in the treatment of *leucorrhea, galactorrhea, hypostatic congestion of the lungs, whooping cough*, the different varieties of *purpura, colliquative sweats, splenic enlargements*, and *exophthalmic goiter.*

Contraindications.—During the first stage of labor and in cerebral or spinal anemia.

Administration.—For its action upon the uterus a valuable

fluid extract is the best preparation as an internal remedy; for hypodermic use the aqueous extract (ergotin) or some of the non-alcoholic fluid preparations manufactured by certain reliable pharmacists for this particular purpose, should be employed. Ergotin may be incorporated in suppositories when for any reason it is desirable to administer the drug *per rectum*.

Gossȳpii Rădicis Cŏrtex—Gossȳpii Rădicis Cŏrticis—Cotton Root Bark. *U. S. P.*

Origin.—The bark of the root of *Gossypium herbaceum* L. and of other species of the genus, indigenous in the tropical and subtropical regions of Asia and Africa. The plant has been cultivated in the United States and other countries from a very early period, many characteristic varieties having been produced.

Description and Properties.—It occurs in thin, flexible bands or quilled pieces, the outer surface brownish-yellow, with slight longitudinal ridges or meshes, small, black circular dots, or short, transverse lines, and dull, brownish-orange patches, from the abrasion of the thin cork; inner surface whitish, of a silky lustre, finely striate; bast-fibers long, tough, and separable into papery layers; inodorous; taste very slightly acrid and faintly astringent.

It contains a fixed oil, a small quantity of tannin, sugar, and starch, a yellow resin, and, in the fresh bark, a pale-yellow chromogene, soluble in alcohol, which on exposure to air becomes red and resinous.

Dose.—15–60 grains (1.04–4.0 Gm.).

Official Preparation.

Extrăctum Gossȳpii Rădicis Flūidum—Extrăcti Gossȳpii Rădicis Flūidi—Fluid Extract of Cotton Root Bark.—*Dose*, ½–1 fluidrachm (1.8–3.7 Cc.).

Antagonists and Incompatibles.—The same as for ergot.

Synergists.—Ergot and its synergists.

Physiological Action.—Identical with that of ergot, but inferior in certainty of action.

Therapeutics.—Cotton root bark is employed only for its action upon the uterine system, in which respect it is identical with ergot. An exception may possibly be in its use in the treatment of *subinvolution* and *tumors of the uterus*, in which cases it is less efficient than ergot.

Contraindications.—The same as for ergot.

Administration.—The fluid extract only should be employed.

Hydrăstis—Hydrăstis—Hydrastis. *U. S. P.*

(Golden Seal.)

Origin.—The rhizome and roots of *Hydrastis Canadensis* L., a perennial native to Canada and the United States east of the Mississippi, growing in rich woodlands and in the Southern States, confined to mountainous districts.

Description and Properties.—The rhizome is from 1 to 2 inches (2–5 Cm.) long and about ¼ inch (6 Mm.) thick, oblique, with short branches, somewhat annulate and longitudinally wrinkled; externally brownish-gray; fracture short, waxy, reddish-yellow, with a thickish bark, about ten narrow wood-wedges, broad medullary rays, and large pith. Roots thin, brittle, with a thick yellow bark and subquadrangular woody centre. Odor slight, taste bitter.

The principal constituents are *hydrastine* (colorless and slightly acrid) and *berberine* (yellow and intensely bitter), the latter alkaloid being also found in berberis, colombo, menispermum, coptis, etc. There is a yellow resinoid (hydrastin) on the market which should not be confounded with the active alkaloid hydrastine.

Dose.—The crude drug is not given internally.

Official Preparations.

Extrăctum Hydrăstis Flūidum—Extrăcti Hydrăstis Flūidi—Fluid Extract of Hydrastis.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Glycerītum Hydrăstis—Glycerīti Hydrăstis—Glycerite of Hydrastis.—Used externally.

Tinctūra Hydrăstis—Tinctūræ Hydrăstis—Tincture of Hydrastis.—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Hydrastīna—Hydrastīnæ—Hydrastine (unofficial).—An alkaloid obtained from Hydrastis.

Origin, Description, and Properties.—Colorless, very brilliant, glassy crystals; taste slightly acrid; fully soluble in ether and chloroform, but freely soluble in water.

Dose.—$\frac{1}{32}$–$\frac{1}{2}$ grain (0.002–0.03 Gm.).

Hydrastinīnæ Hydrochlōras—Hydrastinīnæ Hydrochlorātis—Hydrastinine Hydrochlorate. U. S. P.—*Origin.*—The hydrochlorate of an artificial alkaloid derived from Hydrastine.

Description and Properties.—Light-yellow, amorphous granules, or a pale-yellow crystalline powder, odorless, and having a bitter, saline taste; deliquescent on exposure to damp air. Soluble in 0.3 part of water and in 3 parts of alcohol. The product should be kept in well-stoppered vials.

Dose.—$\frac{1}{12}$–$\frac{1}{2}$ grain (0.005–0.03 Gm.).

Antagonists and Incompatibles.—The alkalies, mineral acids, and tannic and other vegetable acids are incompatible with preparations of hydrastis. The physiological antagonists are chloral, potassium bromide, and the motor depressants.

Synergists.—Quinine and the vegetable bitters aid its action upon the digestive tract, ergot upon the uterus, and strychnine upon the spinal cord.

Physiological Action.—*Externally and Locally.*—Hydrastine possesses considerable anesthetic action when applied locally, and upon the eye its effect is to contract and afterward dilate the pupil.

Internally.—Digestive System.—Its action resembles that of strychnine, though excessive doses produce greater gastric disturbance, almost invariably occasioning vomiting.

Circulatory System.—Its influence is similar to that of strychnine, but not so powerful. In its effect upon the white blood-corpuscles it resembles quinine, arresting their movements.

Nervous System.—Here also the action of hydrastis is analogous to that of strychnine, although it is much less powerful, while more persistent. It differs from its congener, however, in its effect upon the sensory nerve-fibers, very large doses impairing their functional activity, and, when locally applied, producing anesthesia.

Respiratory System.—In its action upon the respiratory system it resembles strychnine, differing in no essential particular.

Absorption and Elimination.—It is slowly absorbed, tending to accumulate in the system. It is eliminated chiefly by the kidneys, increasing slightly the urinary flow.

Temperature.—Medicinal doses have no effect; poisonous doses decrease bodily heat.

Eye.—It has no particular action upon the eye, other than to first contract and then dilate the pupil when directly applied.

Uterus.—Hydrastine is a feeble oxytocic, affecting the womb in a manner similar to, though much less powerful than, ergot.

Untoward Action.—The untoward manifestations are essentially those of poisoning.

Poisoning.—The symptoms are almost identical with those of strychnine.

Treatment of Poisoning.—The same as that of poisoning by strychnine.

Therapeutics.—*Externally and Locally.*—HYDRASTIN (the yellow resinoid)—in the proportion of 5 grains (0.3 Gm.) to 1 ounce (30.0 Cc.) of water, or the fluid extract of hydrastis, 15 to 20 minims (1.0–1.2 Cc.) to 4 ounces (118 Cc.) of water—makes an efficient injection in *gonorrhea.*

HYDRASTINE (the alkaloid), or, preferably, HYDRASTINE HYDRO-

CHLORATE—3 grains (1.2 Gm.) to 1 ounce (30.0 Cc.) of glycerin—affords great relief in certain forms of *chronic conjunctivitis.*

HYDRASTIS is a valuable remedy in *catarrh* of the upper respiratory tract.

The TINCTURE—1 fluidrachm (3.7 Cc.) to 1 ounce (30.0 Cc.) of water—is a valuable mouth-wash in all *indolent* and *offensive ulcerations of the mouth and throat,* such as *syphilitic and mercurial affections, follicular pharyngitis,* etc.

The FLUID EXTRACT serves a useful purpose in the local treatment of *anal fissure* and of *rectal ulcer, vaginal* and *uterine ulcerations,* and *leucorrhea. Indolent ulcers* anywhere, and *chancres* and *chancroids,* are stimulated to a healthier condition by the application of this preparation.

An ointment of HYDRASTINE HYDROCHLORATE, in strength varying from 5–30 grains (0.3–2.0 Gm.) to 1 ounce (32.0 Gm.) of simple ointment, affords an efficient local application in *acne* and *seborrhea sicca,* and the same preparation makes a serviceable dressing for *ulcerated carcinoma* and *bromidrosis.*

The distilled extract of witch-hazel with hydrastine hydrochlorate is recommended in *hyperidrosis.*

Palmer has successfully employed inhalations of a solution of 1 part of the extract to 3 parts of salt water in *tubercular* and *simple bronchitis..*

The topical action of hydrastis and its preparations is that of an antiseptic and tonic, strengthening the circulation and nutrition, rendering the drug peculiarly valuable in diseases of mucous surfaces.

Internally.—As a remedy for diseased conditions of the stomach and bowels it is of much the same value as the vegetable bitters, and may be used for the same purposes.

HYDRASTINE possesses considerable antiperiodic power, having been employed in *intermittent fever* and *chronic malaria,* though much inferior to quinine, and probably also to arsenic. Its beneficial action in these conditions is undoubtedly due to its power to increase the functional activity of the liver, this influence also rendering it valuable in *chronic constipation* induced by hepatic inactivity—*catarrhal jaundice,* too, being frequently relieved by the remedy.

HYDRASTINE, more especially HYDRASTINE HYDROCHLORATE, acts upon the uterus very much like ergot, and has been highly recommended by well-known authorities in *uterine hemorrhage* and other

uterine disorders for which ergot is used. By careful observers, of experience with the drug, it is considered superior to ergot in the *hemorrhage of puberty* and the *menopause*, as well as in *congestive dysmenorrhea.*

Bossi, who has employed hydrastis Canadensis extensively in obstetrical practice, regards it as a valuable hemostatic, believing it to be much safer than ergot in the hands of ignorant individuals and midwives.

Kōniger has treated *hemoptysis* successfully with the FLUID EXTRACT in 20- or 30-minim (1.2–2.0 Cc.) doses, repeated several times a day. The drug has proved equally beneficial in arresting the *night-sweats of phthisis*, and is an efficient substitute for alcoholic stimulants when their use is abandoned.

HYDRASTINE HYDROCHLORATE has recently been favorably mentioned as a remedy for *epilepsy*, *strychnine-poisoning*, and *hydrophobia.*

Contraindications.—The same as for vegetable bitters, strychnine, and ergot.

Administration.—When taken for its action upon the stomach and bowels it should be given before meals; for its effect on the uterus it is best administered in divided doses or the hydrastine hydrochlorate hypodermically.

Rhŭs Toxicodĕndron—Rhōis Toxicodĕndri—Rhus Toxicodendron. *U. S. P.*

(POISON IVY.)

Origin.—The fresh leaves of *Rhus radicans* L., a climbing shrub indigenous in Canada and the greater part of the United States westward to the Rocky Mountains.

Description and Properties.—Long-petiolate, trifoliate, the lateral leaflets sessile or nearly so, about 4 inches (10 Cm.) long, obliquely ovate, pointed; the terminal leaflets stalked, ovate or oval, pointed, with a wedge-shaped or rounded base; the leaflets entire and glabrous or variously notched, coarsely toothed, or lobed, more or less downy; when dry papery and brittle; inodorous; taste somewhat astringent and acrid. The fresh leaves abound in an acrid juice which darkens on exposure to air, and when applied to the skin produces inflammation and swelling. The leaves should therefore not be touched with the bare hands.

The fresh leaves contain a volatile acid (toxicodendric), which

is almost entirely absent in the dried leaves. In addition to this active constituent the leaves contain tannin.

Dose.—1–5 grains (0.06–0.3 Gm.).

Unofficial Preparation.

Tinctūra Rhōis Toxicodĕndri—Tinctūræ Rhōis Toxicodĕndri—Tincture of Toxicodendron.—*Dose*, $\frac{1}{10}$–2 minims (0.006–0.12 Cc.). Prepared from fresh plants —1 part of fresh leaves to 2 parts of alcohol.

Physiological Action.—*Externally and Locally.*—The fresh leaves of this common plant are extremely irritant to the skin, generally acting as a marked vesicant and establishing severe local inflammation, manifested by acute dermatitis, excessive edema, and hyperemia. In many cases these effects are much less pronounced, while in certain individuals they are never occasioned by contact with or even chewing the leaves. As with poison sumach—*Rhus venenata*—the toxic influence of the plant derived from local application is apparently more virulent during the period of florescence.

The inflammation somewhat resembles erysipelas, being rapidly diffused and accompanied by a general systemic disturbance, including abdominal pains, nausea, and vomiting, with perhaps diarrhea, diuresis, and serous passages. Profuse diaphoresis and lumbar and articular pains may also result. These symptoms cease after about ten days or a fortnight without other sequel than desquamation of the affected surface.

Internally.—The effects of the drug administered internally are to cause gastro-intestinal inflammation, with drowsiness and stupor, and occasionally delirium and convulsions. Vertigo, nausea, chilliness, thirst, weak and irregular cardiac movements, diaphoresis, muscular debility, and diuresis are also reported. Dilatation of the pupils is also a result of ingestion or internal absorption, and an illustration of the virulence of the drug is seen in the fact that even air impregnated with exhalations from the leaves may cause epidermic eruption, while the berries have produced serious symptoms in the spinal and cerebral systems, and in an authentic case the root has proved notably fatal.

Treatment of Poisoning.—Many remedies have been used, with varying efficacy, to allay the toxic effects of the drug. Dermal poisoning has been relieved by glycerite of carbolic acid or alkaline lotions. In the earlier stage of external irritation warm soapsuds and sodium bicarbonate have been successfully applied. Alumcurd, ammonia in weak solution, solution of chlorinated soda, and

many other agents have been employed to meet the requirements of certain stages of the affection. A solution of cocaine, 4 to 8 per cent., quickly relieves the cutaneous irritation; a liquid preparation of grindelia robusta makes a grateful application; while opium, coffee, and laxatives would be indicated.

Therapeutics.—*Externally and Locally.*—The diluted tincture—8 minims (0.5 Cc.) to 4 ounces (118 Cc.) of water—has met with some favor, as has been stated, in the treatment of sprains, burns, etc.

In weak solution with alcohol the remedy has been used as a stimulating application in cases of *sprains*, *chilblains*, *burns*, *insect-stings*, etc.

Internally.—It has been recommended in *rheumatic affections of fibrous tissues*, *paralysis*, *erysipelas*, *herpes zoster*, *pemphigus*, *eczema*, and *erythema*.

Dr. Rothrock believes it to be a valuable cerebro-spinal stimulant.

It has been supported as a strong palliative or cure in *incontinence of urine* depending upon atony of the bladder.

It is evident that the drug needs to be much more thoroughly investigated, there being widely diverse opinions regarding its therapeutic value. There is, however, sufficient testimony in its favor from competent authorities to justify further examination and use of this extremely active remedy.

Contraindications.—The meager knowledge we possess respecting its true action in disease renders it impossible to mention any special contraindication to its employment.

Administration.—The tincture is the only preparation used, and should be cautiously administered.

Cōca—Cōcæ—Coca. *U. S. P.*

Origin.—The leaves of *Erythroxylon Coca* Lam., a shrub about 6 feet (1.8 M.) high, with numerous spreading purplish-brown branches, bearing bright green leaves varying in size according to the nature of the plant or of the soil in which it grows. The flowers, found either alone or in clusters, are small, regular, hermaphrodite, white or greenish-yellow, being succeeded by small scarlet berries.

Coca is indigenous in the mountains of Peru and Boliva, and on the eastern slopes of the Andes is cultivated in damp, warm valleys from 3000 to 6000 feet (914.5–1829 M.) above the sea-

level, being also grown in some parts of Colombia, Brazil, the Argentine Republic, and the island of Java. The province of La Paz in Bolivia produces the largest crops, the article being more highly esteemed than the Peruvian variety. *Cocaine*, however, is obtained from leaves of the Javanese plant.

Description and Properties.—In size and shape the leaves resemble those of tea, ovate, lanceolate, or obovate-oblong, from ¾ to 2 or 2¾ inches (2–5 or 7 Cm.) long and 1 to 1½ inches (25–37 Mm.) broad; short-petiolate, entire, rather obtuse or emarginate at the apex, slightly reticulate on both sides, with a prominent midrib, and on each side of it a curved line running from base to apex; odor slight and tea-like, taste somewhat aromatic and bitter, when chewed temporarily benumbing the lips and tongue.

The active constituent is the alkaloid *cocaine*. The plant also contains two other alkaloids—*ecgonine* and *hygrine*, and a peculiar tannin, *coca-tannic-acid*, having a green reaction upon salts of iron.

Dose.—½–4 drachms (2.0–16.0 Gm.).

Official Preparation.

Extrăctum Cōcæ Flūidum—Extrăcti Cōcæ Flūidi—Fluid Extract of Coca.—*Dose*, 20 minims–1 fluidrachm (1.2–4.0 Cc.).

Cocaīna—Cocaīnæ—Cocaine (unofficial).—*Description and Properties.*—Colorless, prismatic crystals, of a strongly alkaline reaction. The taste is bitterish and produces a transient numbness of the tongue. Soluble in 704 parts of water, in much less alcohol and ether, and in fixed oil.

Dose.—½–1 grain (0.03–0.06 Gm.).

Cocaīnæ Hydrochlōras—Cocaīnæ Hydrochlorātis—Cocaine Hydrochlorate. *U. S. P.*

This is the only official salt of cocaine, and the one almost invariably used in medicine.

Description and Properties.—Colorless, transparent crystals or a white, crystalline powder, odorless, of a saline, slightly bitter taste, and producing upon the tongue a tingling sensation followed by numbness of some minutes' duration. Permanent in air, soluble in 0.48 part of water and 3.5 parts of alcohol; very soluble in boiling water and in boiling alcohol.

Dose.—⅛–2 grains (0.008–0.12 Gm.).

Cocaīnæ Phēnas—Cocaīnæ Phenātis—Cocaine Phenate (unofficial).—This salt contains about 75 per cent. of the alkaloid.

Description and Properties.—It occurs as a yellow, viscid mass. Soluble in alcohol, insoluble in water.

Dose.—$\frac{1}{12}$–$\frac{1}{6}$ grain (0.005–0.01 Gm.).

Antagonists and Incompatibles.—Morphine, chloral, amyl-nitrite, alcohol, chloroform, and ether are physiological antagonists. The most direct opponents are chloral and morphine.

Cocaine is incompatible with caustic alkalies and the alkaline carbonates and bicarbonates, as well as with bichloride of mercury, iodine and the iodides, ammonia, zinc chloride, and borax.

Synergists.—Medicinally, its cerebral effects may be enhanced by the cerebral stimulants, such as alcohol, cannabis Indica, and belladonna, while its analgesic and anesthetic action may be aided by carbolic acid, atropine, opium, and conium. When used as a mydriatic atropine serves as a valuable synergist.

Physiological Action.—For our first knowledge of the physiological properties of coca we are indebted to its empirical use among the natives of Peru. The history of the drug is replete with interest and romance. It was regarded as the living representation of the Deity, the ground whereon it grew being held sacred. During the reign of the Incas its use was a royal privilege, the people being compelled to obtain permission from the governor to avail themselves of its benefits. Later it was adopted indiscriminately.

The native *coqueros* (coca-chewers) have learned from experience that they can climb the Andes, work laboriously in the mines, and endure fatigue and hunger more hardily when chewing the leaves of the plant, and from time immemorial the drug has been recognized by observers as possessing powerful nutritive, stimulant, and restorative properties.

In describing the action of the crude drug the author can add little to the words of Linnæus, who long ago wrote that coca possessed "the penetrating aroma of vegetable stimulants, the astricting and fortifying virtues of an astringent, the antispasmodic qualities of bitters, and the mucilaginous, nutritive properties of analeptics or of alimentary plants." "This leaf," he adds, "exhibits with energy its action on all parts of the animal economy. *Olido in nervos, sapido in fibras, utroque in fluido.*"

Since the isolation of the alkaloid cocaine, to which the drug owes its physiological and medical properties, by Gaedeke in 1855, and the subsequent study of it by eminent pharmacologists and therapeutists, we have learned more of the physiological action of coca. Its effect upon different systems are here described in detail.

Externally and Locally.—Cocaine is analgesic, anesthetic, and

ischemic. Upon the unbroken skin it has no action, but upon mucous membranes or the subcutaneous tissue it produces complete local anesthesia. The surface to which it is applied becomes paler than normal, owing to contraction of the blood-vessels, but afterward reddens and appears turgescent through secondary dilatation of the vessels. The absorption of the drug by mucous membranes varies with the locality to which it is applied—with difficulty from the conjunctiva, yet with great readiness from the Schneiderian membrane, producing its characteristic constitutional effects.

Applied to the conjunctiva, or even taken internally, cocaine causes a transitory contraction of the pupil, soon followed by dilatation. The accommodation is impaired, but not completely destroyed, the ocular tension being lowered.

The anesthetic action of cocaine applied locally is due to the depression of the ends of the sensory nerves. It dilates the pupil by stimulating the ends of the sympathetic nerve, which innervates the radiating fibers of the iris.

In addition to its local analgesic action the drug possesses the power of destroying the functions of the nerves of special sense, so that taste and smell, as well as the tactile sense, are abolished. When applied locally or taken internally it primarily checks many of the secretions, though those from the pancreas and liver seem to be uninfluenced by its internal use. The secondary impression of cocaine, however, when the blood-vessels become dilated, is accompanied by increased secretion.

François-Franck, who has made an exhaustive study of the local action of cocaine, contends that it is "a powerful paralyzing poison, acting alike on sensory and motor nerve-endings, on all kinds of peripheral nerves, on nerve-centers, muscles, glands, epithelium, leucocytes, vegetable protoplasm, micro-organisms, etc."

Internally.—Digestive System.—On account of its stimulant action upon the constrictor fibers of the great sympathetic nerve, under the influence of moderate doses peristalsis is largely increased in the stomach and intestines, very large or poisonous doses, on the contrary, causing great sluggishness of the bowels.

Although it has been shown by experiments upon animals that cocaine is incapable of sustaining life, it diminishes in man the sensation of hunger, owing to its local anesthetic action upon the mucous membrane of the stomach, so that the *coqueros* are able to

abstain from food for days, thirst also being allayed. This diminution of hunger does not seem to impair appetite and digestion, since food is subsequently relished and digested as well as, if not better than, if coca had not been used.

Circulatory System.—Medicinal doses of cocaine increase the force and frequency of the cardiac contractions, and also arterial pressure. Large or poisonous doses render the pulse slow, soft, and weak, and lower arterial tension. The exact *modus operandi* is not fully determined, such eminent authorities as Mosso, Von Aurep, Vulpian, Ott, Nikolsky, and others differing as to its action upon the circulatory apparatus. It is quite probable that its action is similar to that of atropine in this respect.

Nervous System.—When given internally its first action is upon the brain, moderate doses greatly stimulating the intellectual faculties and producing a feeling of ecstasy and well-being, in many respects akin to the sensations experienced under the action of cannabis Indica. In the course of a few hours the stage of cerebral excitement is succeeded by mental, moral, and muscular depression.

Toxic doses result in incoherent speech and wild delirium, accompanied by swaying of the head, followed by epileptiform convulsions and narcosis. The convulsions are of cerebral origin, the effect of cocaine upon the spinal cord being yet but imperfectly understood.

The sensory nerves are depressed by small and paralyzed by lethal doses. The motor nerves are also depressed by large doses, this action, however, being subordinate to that exerted upon the sensory nerves. The muscles are stimulated by medicinal doses through impression upon the motor tracts, although large doses greatly depress muscular activity. The chewing of coca, as practised by the natives of Peru and Bolivia, undoubtedly appears to augment muscular strength and powers of endurance.

Mosso claims that small doses of cocaine serve as a powerful muscular stimulant in cases of exhaustion from hunger or fatigue.

Laffont states that cocaine possesses an "excito-functional action on the great sympathetic constrictor nerve, consequently an exaltation of the functional action of all the non-striated muscles or muscles of organic life which are subordinated to it."

Respiratory System.—Medicinal doses powerfully stimulate the respiratory center, increasing the rapidity and depth of the respira-

tions. Poisonous doses paralyze the center, the result being dyspnea, feeble breathing, and death from respiratory failure.

Absorption and Elimination.—Cocaine is quickly absorbed, being eliminated principally by the kidneys in a form differing from its original nature. Much of it undergoes oxidation in the body. The amount of urine is increased, though the nitrogenous elements are diminished. The habitual use of the drug lessens urinary secretion.

Cocaine possesses no cumulative action, although its effects become more marked under repeated dosage, due probably to some special dynamic action upon the nervous system.

Temperature.—Medicinal doses have no influence on bodily heat, but poisonous doses usually raise the temperature, owing, according to Reichert, to an increase of heat-production.

Eye.—Cocaine produces a noticeable dilatation of the pupil, as already explained under "Local Action," the maximum change being reached in about an hour, and the normal state regained in from twelve to twenty-four hours.

Cocaine-poisoning.—Among the more prominent physiological symptoms resulting from the ingestion of excessive doses of cocaine or repeated and continued injections are a tendency to coma or collapse; a feeble, thready pulse, often running extremely high; great emaciation; anorexia and impairment of the digestive powers; and increased frequency, and again alarming depression, of respiration. There are other symptoms, scarcely less serious, which, as the majority of observations show, render cocaine one of the most generally deleterious of drugs, opium not excepted. Dropsy, marasmus, numbness, syncope, profound malaise, muscular twitchings with mild convulsions, insomnia, amblyopia, mydriasis, visual hallucinations, headache, vertigo, dangerously elevated temperature, dental decay, and fetid breath,—even this admonitory catalogue of ills fails to complete the recorded phenomena attending poisoning from cocaine.

Yet, grave as are the foregoing physical changes incident to an immoderate use of the drug, the mental and, above all, the moral effects of cocaine-poisoning are far more deplorable. It is a melancholy but indubitable fact that to one fully committed to the so-called "cocaine habit" there appears at times no principle of honor or decorum to which the vitiated sensibilities are amenable. The enfeeblement of the intellectual faculties, the loss of memory, inability to coördinate or control ideas, a consciousness occasionally merged

in pronounced mania, possibly with homicidal inclination, and an intense selfishness of thought and purpose, in which apathy, neglect of domestic obligations, and complete debasement of nobler qualities are developed,—these lamentable accompaniments manifest too clearly the degenerating influences exerted by a constant resort to the use of this ill-fated, if not fatal, drug.

An instance coming under the author's personal observation will serve to illustrate the entire lapse of the subject's morale. The case is that of a well-known, successful, and highly esteemed practitioner, who, becoming addicted to the employment of cocaine as an alleviation for bodily and mental depression, reached at last a stage of moral degradation in which he neither shrank from lying and stealing nor considered any means of gratifying his diseased appetite too abject—the persuasions of friends, the considerations of professional duty and social position, and the distracted appeals of his own family being alike unavailing to arrest the passion to which he had succumbed. It is grateful to record that from his moral turpitude the subject at length emerged triumphantly, to-day occupying a proud position reflecting honor upon himself and his profession.

A still more distressing case, in that it was attended with fatal results, is that of a physician personally known to the author who, contracting the cocaine habit, in blind folly administered the drug to his wife and child, all dying within the period of a few months.

The desperation to which the cocaine habitué may be driven in his temporary madness is shown in the case of a young man scarcely twenty years of age, son of an eminent surgeon, who, the author is authentically informed, during a journey by rail in which he was deprived of the customary facilities for hypodermic injection, ripped open his arm with a pocket-knife and poured the drug into the wound.

In such cases the salient features of the malady may be properly regarded as allied to those of acute mania, the treatment being exceedingly difficult—the more so because of the absence of deterrent motives prompted by conscience, which in the course of the indulgence becomes torpid or perverted. There is, moreover, with cocaine-poisoning always danger of deliberate or involuntary relapse.

It frequently happens that cocainism arises from a desire to relieve effects produced by the immoderate use of opium. Yet the latter drug, being taken to offset the influence of cocaine, in reality

but aggravates the evil, the two agents interacting and still further lessening the chances of recovery.

Treatment of Poisoning.—Several antidotes have been favorably adopted—amyl nitrite, caffeine, atropine, and inhalations of ammonia. Chloroform, ether, subcutaneously injected, and strychnine have also proved more or less efficient remedies.

With regard to the withdrawal of cocaine, equally competent authorities appear to differ, the immediate cessation of the drug being advocated, and again this course condemned as liable to produce collapse. The author is of the opinion that, as in other respects, the procedure followed in the treatment of the opium habit is the wisest and safest.

The disease, however, at least during its more serious manifestations, is essentially allied to insanity, and permanent cure must look to the *rationale* of the conditions, with the paramount object of restoring to its normal activity the moral tone of the patient's thought and desire. That complete regeneration of mind and body may be reasonably contemplated is amply attested by the case above cited; nor should discouragement deter the physician from his task, nor measures of untimely severity be suffered to exasperate and confirm an untoward mental state possibly susceptible of intelligent control.

Therapeutics.—*Externally and Locally.*—The indications for the local anesthetic action of COCAINE are very numerous. The general surgeon will find many opportunities to employ the drug advantageously; indeed, in many instances it has replaced all other anesthetics. In many operations on the genito-urinary tract, rectum, nose, throat, ear, and eye it serves a most valuable purpose. The urethra can be rendered perfectly insensible to pain by the application of a 2 to 4 per cent. solution, repeated two or three times at intervals of five or ten minutes. Even the sensibility of the bladder itself can be benumbed to a great extent by the local application of a cocaine solution, so that *sounding for stone* may be painlessly accomplished. A case of *lithotrity* is reported in which, without suffering, an operation was performed in fifteen minutes, the only anesthetic used being a solution of cocaine applied to the parts.

Urethral caruncles may be removed successfully and without inconvenience to the patient by the injection of a 4 per cent. solution at the lines of attachment. An injection of a small amount of the same solution into the cellular tissue of the prepuce pre-

vents pain in *circumcision* and in the operation for *phimosis*. In the treatment of *fistula in ano*, *hemorrhoids*, both internal and external, and other *diseases of the rectum*, cocaine is of signal value.

An OINTMENT OF COCAINE, 4 per cent. strength, affords a grateful anodyne dressing for *burns*, it being borne in mind that in all cases where ointments of this drug are used the alkaloid cocaine, and not its salts, is to be employed.

Cocaine is an important anesthetic in many minor operations, such as opening of *felons*, *abscesses*, etc.; it is also highly serviceable in dentistry and for the removal of *small neoplasms*. Probably its most extensive use in this respect is in operations upon the eye, nose, and throat, its widest field of usefulness being in operative ophthalmic surgery.

The following prescription makes an efficient application for the relief of many of the distressing symptoms of *acute coryza* and *hay fever:*

℞. Cocainæ hydrochloratis, gr. x (0.6 Gm.);
Menthol, gr. xij (0.72 Gm.);
Pulveris camphoræ, gr. iij (0.2 Gm.);
Pulveris magnesiæ,
Sacchari lactis, *āā.* ʒij (8.0 Gm.).

M.—Sig. Use a small portion as a snuff twice a day.

A small quantity of morphine sulphate is sometimes an excellent addition to the above.

Great care should be taken in the administration of this snuff, since its frequent use may easily induce the cocaine-habit.

The peculiar qualities of cocaine render it one of the safest, as well as most convenient and serviceable, mydriatics. It quickly dilates the pupil, which regains its normal condition in from ten to twenty hours. The dilatation, too, is easily overcome by the application of eserine, a solution of $\frac{1}{2}$ grain (0.03 Gm.) to 1 ounce (30.0 Cc.) of the latter drug being strong enough to neutralize the effects of a 4 per cent. solution of cocaine.

It should be remembered that local applications to the conjunctivæ, nares, and fauces may produce in susceptible persons systemic effects.

Cocaine combined with atropine forms a mydriatic which for many purposes is superior to either drug separately, the mydriasis being of longer duration than that produced by cocaine, while the paralysis of the accommodative apparatus is briefer than that

occasioned by atropine. It should be remembered that isa-tropyl cocaine may cause great cardiac depression.

The PHENATE OF COCAINE is less toxic than the hydrochlorate, owing to its power of coagulating albumin, and thereby being less readily absorbed. It is also more agreeable to the taste. While it does not produce anesthesia so readily as the hydrochlorate, its effect is more permanent, and, in addition, it possesses powerful antiseptic properties. By many physicians it is preferred in laryngological work.

Internally.—COCA has been successfully used in *gastralgia* and to *improve the digestion.* COCAINE is frequently an efficient remedy in *sea-sickness* and to allay *excessive vomiting.*

Bartholow has highly recommended the drug in *chorea, asthma, paralysis agitans*, and *alcoholic* and *senile tremor.* It has also been suggested as a cure for the *opium, alcohol*, and *tobacco habits.*

The WINE OF COCA is an excellent tonic during *convalescence* from acute disease and in debilitated conditions generally. It has been extensively employed in *melancholia.*

COCAINE combined with atropine is said to make an efficient hypnotic.

Contraindications.—No special or distinct contraindication to its use exists. In diseases of the kidneys with diminished urinary flow it should be cautiously administered, lest cumulative effects ensue. With subjects suffering from weak or diseased heart similar caution is to be used.

Administration.—For hypodermic use solutions of from 2 to 5 per cent. are generally employed.

It should be noted that children and females require smaller doses of the drug.

It is altogether probable that many of the coca wines on the market contain varying quantities of cocaine. The reckless and indiscriminate prescription of these preparations, therefore, is liable to induce the cocaine habit. It is questionable, indeed, whether the administration of cocaine with a view to curing the intemperate use of opium, alcohol, or tobacco is wise. It frequently happens that patients thus treated lose their craving for the latter drugs only to acquire an inordinate appetite for cocaine, which, as has been shown, is possibly more dangerous than either of them in its physical and moral effects.

GROUP VII.—MOTOR DEPRESSANTS.

Conīum—Conīi—Conium. *U. S. P.*

(Hemlock.)

Origin.—The full-grown fruit of *Conium maculatum* L., gathered while yet green. Spotted hemlock is a biennial indigenous in the temperate regions of Asia, Europe, and Northern Africa, and naturalized in some portions of New England, New York, and South America. It grows in waste places and along streams.

Description and Properties.—About $\frac{1}{8}$ inch (3 Mm.) long, broadly ovate, laterally compressed, grayish-green, often divided into two mericarps, each with five crenate ribs, without oil-tubes, and containing a seed grooved on the face; odor and taste slight.

When triturated with solution of potassium or sodium hydrate conium gives off a strong, disagreeable, mouse-like odor.

The most important constituent is a volatile liquid alkaloid, *coniine*. It also contains methyl-coniine, conhydrine, and its isomer pseudo-conine.

Dose.—1–5 grains (0.06–0.3 Gm.).

Official Preparations.

Extrăctum Conīi—Extrăcti Conīi—Extract of Conium.—*Dose*, $\frac{1}{2}$–1 grain (0.03–0.06 Gm.).

Extrăctum Conīi Flūidum—Extrăcti Conīi Flūidi—Fluid Extract of Conium.—*Dose*, 1–5 minims (0.06–0.3 Cc.).

Unofficial Preparations.

Tinctūra Conīi—Tinctūræ Conīi—Tincture of Conium (15 per cent.).—*Dose*, 10–30 minims (0.6–1.8 Cc.).

Sŭccus Conīi—Sŭccus Conīi—Conium Juice.—*Dose*, $\frac{1}{2}$–2 fluidrachms (1.8–7.4 Cc.). The juice expressed from fresh leaves, and $\frac{1}{3}$ volume of alcohol added to preserve it.

Coniīna—Coniīnæ—Coniine.—*Description and Properties.*—A colorless, inflammable, oily liquid, having a strong alkaline reaction and a penetrating, suffocating odor. It is soluble in all proportions in alcohol, ether, chloroform, benzene, benzin, and fixed oils. It requires 100 parts of cold water for solution, the liquid becoming turbid on warming.

Dose.—$\frac{1}{10}$–1 minim (0.006–0.06 Cc.).

Coniīnæ Hydrobrōmas—Coniīnæ Hydrobromātis—Coniine Hydrobromate.—*Description and Properties.*—It occurs in colorless, transparent prisms; soluble in water and alcohol in the proportion of 1 to 2 parts; very slightly soluble in ether.

Dose.—$\frac{1}{30}$–1 grain (0.002–0.06 Gm.).

Antagonists and Incompatibles.—Nux vomica and its alka-

loids, cocculus and picrotoxin, are antagonistic to conium. Tannic acid and the alkalies are chemically incompatible.

Synergists.—The motor depressants and morphine.

Physiological Action.—*Externally and Locally.*—Coniine, the active principle of conium, has no effect upon the unbroken skin. Applied to bruised surfaces, it has been thought to possess anesthetic or analgesic properties.

The specific behavior of the drug, however, renders the above action problematical, according to some authorities.

Internally.—Digestive System.—Conium increases the salivary secretion, and when taken into the stomach exerts no special action upon the digestive system, other than an occasional disturbance of the gastro-intestinal tract, possibly resulting in vomiting and diarrhea under full dosage.

Circulatory System.—Although when ingested coniine is rapidly absorbed by the blood; circulating in the system unchanged, its action is not clearly defined, though it has been held that the circulation is first accelerated and then retarded, with a lowering of arterial pressure preceded by a decided increase.

From its capacity to paralyze the terminal vagi it is natural to suppose that it increases the rapidity of the cardiac movements, yet a characteristic feature of the absorption of coniine is the apparent absence of cardiac derangement, the heart, as well as the mind, remaining unaffected in the presence of alarming symptoms.

Nervous System.—The brain is unaffected, consciousness being preserved to the last; muscular irritability is uninfluenced; and even under large doses there is little impression made upon the nerves beyond a slight impairment of their conductivity, thus interfering with the transmission of motor impulses. This latter influence is first manifested in the peripheries, gradually ascending until the spinal cord is involved, the reverse process marking the effects of the methyl-coniine.

Respiratory System.—Large or poisonous doses act as depressants upon the respiratory center in the medulla, and, although the breathing may at first be normal, paralysis and asphyxia may finally result from immoderate ingestion.

Absorption and Elimination.—The drug is readily absorbed, elimination taking place by various channels, but chiefly through the kidneys and by expiration. Coniine has been detected in considerable quantities in the liver, lungs, and spleen.

Temperature.—It has been held that bodily temperature is perceptibly lowered by conium, proportionately with the extent of the paralysis occasioned. High authorities, however, assert an increase of temperature under both therapeutic and toxic doses.

Eye.—Heaviness of the eyelids, dilated pupils, accompanied by double or confused vision and occasionally entire loss of sight, have been noted among the symptoms incident to the administration of active dosage. The effects thus recorded have been ascribed to paralysis of the third nerve rather than to stimulation of the sympathetic.

Poisoning.—A frequent symptom of conium-poisoning is ptosis, arising from paralysis of the oculo-motor nerves. Staggering gait, general muscular relaxation, impairment of vision, nausea, and vertigo are also not infrequent. The severer symptoms are marked by muscular paralysis of the extremities, derangement of vocal organs resulting in difficulty of speech, and dilatation of the pupils. The brain meanwhile remains unaffected until overcome by the accumulation of carbonic-acid gas in the blood, when delirium and coma may ensue, and finally cerebral convulsions and fatal collapse through respiratory failure.

With regard to the effect of toxic doses upon the heart conflicting statements are recorded, experiment having proved that in warm-blooded animals the cardiac movements speedily cease, it being authoritatively stated, on the other hand, that the drug exerts no influence upon the heart.

Treatment of Poisoning.—The stomach should be evacuated by means of emetics or lavage, after which tannic acid and the physiological antidotes may be administered—tetanizing agents, such as strychnine and picrotoxin, with alcoholic stimuli if necessary. Coffee and also hypodermic injections of atropine have been highly recommended. Muscular exercise has been known to delay the action of the poison, and free counter-irritation by mustard may be serviceable.

Therapeutics.—*Externally and Locally.*—In many respects the medicinal operation of CONIUM bears no relation to its physiological action. Experimentation shows that it exerts but a feeble action upon the sensory nerves, yet clinical experience establishes its value in mitigating the pain of *cancer* when locally applied. In ulcerating *cancer of the breast* especially, poultices composed of conium leaves afford wonderful relief from pain and greatly improve the condition. A similar application has proved beneficial

in *scrofulous glandular sores.* Dewees has recommended an injection composed of the EXTRACT 3 parts to water 16 parts in *uterine cancer.*

Ovarian menorrhagia is well treated by inserting in the vagina once or twice daily a suppository containing 1 or 2 grains (0.06–0.12 Gm.) of CONIUM.

Acute laryngitis may be greatly relieved by the inhalation of a solution containing 2 fluidrachms (7.4 Cc.) of SUCCUS CONII to 16 or 20 ounces (473–591.5 Cc.) of water and 20 grains (1.2 Gm.) of sodium carbonate.

The vapor of CONIINE inhaled is an efficient palliative of the *cough of phthisis* and *acute bronchitis.*

The peculiar mouse-like odor renders the use of CONIUM in diseases of the respiratory tract objectionable to many persons.

Internally.—Its action upon the motor mechanism gives value to the drug in diseases characterized by excessive motor activity. CONIUM is therefore an efficient remedy in allaying the motor excitement of *acute mania.* Advantage has been taken of its action in the treatment of *asthma,* and in *chorea* and *paralysis agitans* it certainly serves a useful purpose.

It has been claimed that *whooping cough* yields to its influence. It has proved beneficial in other spasmodic affections, such as *tetanus* and *blepharospasm* accompanying many acute inflammations of the eye. CONIINE has even been suggested as a remedy in *hydrophobia* and *strychnine-poisoning.*

CONIINE HYDROBROMATE has been proposed by Wolfenden as an efficient remedy in *epilepsy.*

CONIUM has also been suggested in *puerperal convulsions,* while in *infantile convulsions* the drug has been employed with great benefit, being well tolerated by children.

CONIINE has been used hypodermically and with marked success to relax the muscles in *dislocations of the joints,* as well as in *pneumonia* and *pleurisy.* In the latter diseases the drug so depresses the ends of the motor nerves that the impulse exciting the respiratory muscles is interfered with and the cough greatly relieved, a reduction of the pulse-rate and temperature usually accompanying the cessation of coughing.

Contraindications.—Conium should not be given to persons suffering from great exhaustion and debility or from diseases interfering with the rhythm of the heart.

Administration.—The preparations of conium are very unreli-

able, the assayed, or "standardized" fluid extract being perhaps the one to be depended upon most uniformly. Owing to the uncertainty of their strength, the administration should begin with small doses gradually augmented until interference with involuntary motion is observed, when further increase should be stopped.

The effects of the drug are weakened by repeated doses, rendering an increase in the dose necessary from time to time. Coniine and morphine greatly aid each other, and this combination is a particularly efficient one in the treatment of painful muscular spasms and acute mania with excessive motor activity.

Dr. Squibbs has stated that there is danger in diluting the fluid extract, a precipitate being formed containing the active principle.

Curāre—Curāre—Curare.

(WOORARI.)

Origin.—An extract of uncertain composition prepared by the natives of South America as an arrow-poison. Dr. Jobert reported to the French Academy in 1878 that the poison was prepared chiefly from *Strychnos Castelnæana* and other species of *Strychnos*, and *Cocculus toxiferus*, containing also variable quantities of other poisonous plants, such as *Didelphys cancrivora*, etc. It is altogether probable that its ingredients include the poison of venomous reptiles.

Description and Properties.—The extract is a blackish-brown, friable solid, brittle or hygroscopic, of a very bitter taste; almost completely soluble in dilute alcohol. Cold water dissolves about 75 per cent., which portion contains the poisonous alkaloids and is insoluble in ether and but sparingly soluble in absolute alcohol.

Two alkaloids have been obtained from this substance—*curarine* and *curine*.

Dose.—$\frac{1}{20}$–$\frac{1}{2}$ grain (0.003–0.03 Gm.), hypodermically given.

Dose of Curarine.—$\frac{1}{200}$–$\frac{1}{100}$ grain (0.0003–0.0006 Gm.), hypodermically.

Antagonists and Incompatibles.—The excito-motors are antagonistic. Tannic acid and the caustic alkalies are chemically incompatible.

Synergists.—The depresso-motors.

Physiological Action.—When applied to the denuded skin it is a powerful irritant; introduced into the circulation hypodermically, it exerts a very decided and characteristic action.

Circulatory System.—Medicinal doses render the pulse fuller

and exceedingly rapid; there is marked dilatation of the blood-vessels of the skin and the various glands; while the blood-pressure, though little affected by small doses, is decidedly lowered by large ones. The action on the circulation is due to diminished inhibition on the heart, owing to paralysis of the ends of the vagi, while the accelerator nerves are stimulated.

Nervous System.—Immoderate doses cause great muscular weakness and paralysis of all the voluntary muscles. The ends of the motor and sensory nerves are paralyzed, the former being soonest affected. Beyond a slightly diminished contractility the voluntary muscles are but little influenced. The spinal cord may be paralyzed under toxic doses, although the brain-centers remain unaffected until carbonic-acid narcosis sets in.

Respiratory System.—Curare is a powerful respiratory depressant, paralyzing the ends of the motor nerves distributed to the respiratory muscles. When lethal doses have been given the paralysis becomes central, finally producing death by its action on the respiratory muscles.

Absorption and Elimination.—When ingested the process of absorption is exceedingly slow, but when injected into the circulation the drug is rapidly absorbed.

It is quickly eliminated by the kidneys, causing sugar to appear in the urine. A portion of the poison is also excreted with the feces. The sweat, saliva, nasal mucus, and tears, although their secretion is greatly increased by the drug, do not seem to share in the process of elimination.

Temperature.—The temperature is elevated.

Eye.—Under poisonous doses there is marked ptosis, disordered vision, protrusion of the eyeballs, and, as a late ocular symptom, myosis.

Poisoning.—Curare is a rapid and active poison. The movements of the heart are greatly accelerated; the pulse is weak and dicrotic; the temperature is elevated, and the respiration correspondingly depressed; extreme muscular weakness ensues, with incoördination of movements; the urine becomes saccharine. Finally, paralysis of the extremities and the respiratory muscles supervenes, death occurring from respiratory paralysis.

Treatment of Poisoning.—The same as in the treatment of poisoning from conium, with catheterization of the bladder to favor elimination, and artificial respiration.

Therapeutics.—While of great scientific interest and of value

for experimental purposes in ascertaining the effect of certain drugs upon animals, the therapeutic uses of curare are quite limited, being confined to certain spasmodic diseases, particularly *hydrophobia*. The remedy has also been used with varying success in *chorea*, *tetanus*, and *epilepsy*, but when the convulsions are due to excessive activity of the cerebral motor areas the bromides are superior to curare.

Contraindications.—The same as for conium.

Administration.—The crude drug or the alkaloid *curare* should be given hypodermically.

Gelsēmium—Gelsēmii—Gelsemium. *U. S. P.*

(Yellow Jasmine.)

Origin.—The rhizome and roots of *Gelsemium sempervirens* (L.) Pers., a plant indigenous in the southern United States, growing in moist woods.

Description and Properties.—Cylindrical, long or cut in sections about 1 inch (25 Mm.) in length, externally light yellowish-brown, with purplish-brown longitudinal lines; tough, fracture splintery; bark thin, with silky bast-fibers closely adhering to the pale-yellowish, porous wood, which has five medullary rays, and in the rhizome a thin pith; odor aromatic, heavy; taste bitter.

It contains an alkaloid, *gelsemine*, which forms its active principle, gelseminine, gelseminic acid, volatile oil, resins, gallic acid, etc.

Dose.—2–10 grains (0.13–0.6 Gm.).

Official Preparations.

Extractum Gelsēmii Flūidum—Extracti Gelsēmii Flūidi—Fluid Extract of Gelsemium.—*Dose*, 2–10 minims (0.12–0.6 Cc.).

Tinctūra Gelsēmii—Tinctūræ Gelsēmii—Tincture of Gelsemium.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Gelsemīna (unofficial)**—Gelsemīnæ—Gelsemine.**—*Description and Properties.*—A brittle solid, transparent, crystallizable mass, converted into a colorless liquid at 45° C. (113° F.). Insoluble in cold water, but soluble to a slight extent in hot water, as well as in alcohol; taste bitter.

Dose.—$\frac{1}{200}$–$\frac{1}{40}$ grain (0.0003–0.001 Gm.).

Antagonists and Incompatibles.—The cardiac and diffusible stimulants are antagonistic; tannic acid and caustic alkalies are incompatible, precipitating the alkaloid.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—It is a mild sedative and astringent, the alkaloid being a mydriatic.

Internally.—*Digestive System.*—No special action has been

noted, though when excessive doses have been taken nausea and vomiting may ensue.

Circulatory System.—Medicinal doses of gelsemium produce no marked effect, but toxic doses reduce the heart's action, rendering the pulse slower and weaker and lowering arterial tension.

Nervous System.—The drug has no effect upon higher cerebral centers, the mind remaining clear to the last. In large doses it paralyzes the roots of the motor cerebral nerves and the motor areas of the spinal cord, with consequent paralysis of all the muscles of the body, and, according to some authorities, terminal nerve filaments are paralyzed. This condition is succeeded by cutaneous anesthesia, due to depression of the receiving center and the sensory tract in the spinal cord. The motor nerves and muscles are unaffected. Convulsions rarely result in man from a poisonous dose, but occur in animals, with backward movements. The exact cause of this action is undetermined.

Respiratory System.—The breathing is rendered slower and shallower, being frequently irregular. Death results from asphyxia, caused by depression and ultimate paralysis of the respiratory center.

Absorption and Elimination.—Gelsemium is speedily absorbed and readily excreted, chiefly by means of the kidneys. Untoward symptoms produced by immoderate amounts of the drug practically subside within three hours after ingestion.

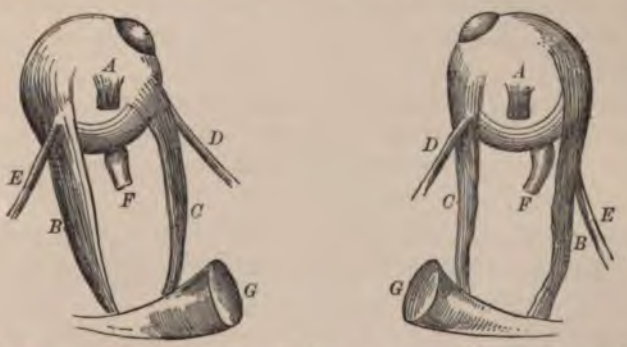

FIG. 8.—Diagram showing how gelsemium produces convergent strabismus: *A,A*, superior rectus; *B,B*, external rectus—too weak; *C,C*, internal rectus; *D,D*, third nerve; *E,E*, sixth nerve; *F,F*, optic nerve; *G,G*, lesser wing.

Temperature.—Poisonous doses cause a reduction in temperature.

Eye.—Under full dosage the pupil is widely dilated and diplopia and marked ptosis ensue. The mydriasis and ptosis are caused by

paralysis of the third nerve. The sixth, which innervates the external rectus muscle, is often depressed more than the third nerve, supplying the internal rectus, producing convergent strabismus, as shown in Figure 8.

The diplopia is caused by the squint and incoördination of the ocular movements. In strabismus the eyes are not directed exactly to the object, and the image does not fall on corresponding parts of the retinæ; consequently, two perceptions are received in the visual center and two objects apparently seen.

Uterus.—No important action has been observed.

Untoward Action.—This does not essentially differ from that observed in poisoning, though the symptoms may be of a milder form.

Poisoning.—In toxic doses gelsemium is quickly fatal. The early symptoms include drooping of the eyelids, wide dilatation and immobility of the pupils, extreme muscular weakness, affecting first the muscles of the upper extremities, and incoördination of movements. Diplopia and dimness of vision may ensue, accompanied by difficulty of speech, coldness of the body surface, and general cutaneous anesthesia, with decidedly lower temperature. Meanwhile, there is marked diminution in the force and frequency of the pulse and respiration.

While the patient may be drowsy, the mind is unaffected until carbonic-acid narcosis supervenes. Death is usually the result of respiratory failure, due to paralysis of the muscles of respiration. (See Plate I.)

Treatment of Poisoning.—The evacuation of the stomach is of the first importance, either by the stomach-pump or by the use of emetics. Washing out with a solution of tannic acid is probably the best method to pursue. External heat should be applied and diffusible stimulants administered, followed by digitalis and strychnine. The hypodermic injection of morphine and atropine is highly recommended in gelsemium-poisoning.

Therapeutics.—*Externally and Locally.*—The drug is seldom used externally, although it has been employed by ophthalmologists as a mydriatic.

Internally.—Clinically, gelsemium is now considered less valuable than formerly. It has been favorably mentioned by certain authors in the treatment of *tetanus, mania* with motor excitement, and *paralysis agitans.* Theoretically, it would seem to be of value in certain convulsive disorders, like *chorea, pertussis,* etc., yet its

PLATE II.

Gelsemium-poisoning.

use has not met with the success which its action upon the muscular system would indicate.

The drug appears to be more serviceable in *trifacial neuralgia*, and it seems to be even more efficient in neuralgia with involvement of the inferior dental nerve. In these disorders, as in *ovarian neuralgia*, *dysmenorrhea*, etc., for which it has been employed with some success, the drug should be pushed to its physiological limit.

Bartholow praised the action of gelsemium in *cerebro-spinal meningitis* and "*acute inflammations of the lungs and pleura.*"

Bulkley is responsible for its use in *pruritus* and *eczema*, the itching of which it certainly appears to alleviate.

The therapeutics of gelsemium would perhaps be incomplete without mentioning *hemoptysis*, *remittent fever*, *acute coryza*, *migraine*, *Ménière's disease*, and *spermatorrhea*, in all of which the drug has been used and recommended.

Contraindications.—Diseases accompanied by exhaustion and great muscular weakness.

Administration.—Any of the preparations may be given, the initial dose being small, and the amount increased gradually until dilatation of the pupil or drooping of the eyelids is manifest.

Grindēlia—Grindēliæ—Grindelia. *U. S. P.*

Origin.—The leaves and flowering tops of *Grindelia robusta* Nutt, and of *Grindelia squarrosa* Dunal, herbaceous or suffruticose perennials indigenous in the western part of North America and Mexico.

Description and Properties.—Leaves about 2 inches (5 Cm.) long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate, often spinous-toothed or even laciniate-pinnatifid, pale-green, smooth, finely dotted, thickish, brittle; heads many-flowered, subglobular or somewhat conical, the involucre hemispherical, about $\frac{3}{8}$ inch (10 Mm.) broad, composed of numerous imbricated, squarrose-tipped, or spreading scales; ray-florets yellow, liqulate, pistillate; disk-florets yellow, tubular, perfect; pappus consisting of two or three awns of the length of the disk-florets; odor balsamic; taste pungently aromatic and bitter.

The principal constituent is probably a resinous substance. It also contains an alkaloid principle, grindeline, and a volatile and a fixed oil.

Dose.—10–60 grains (0.6–4.0 Gm.).

Official Preparation.

Extractum Grindeliæ Fluidum—Extracti Grindeliæ Fluidi—Fluid Extract of Grindelia.—*Dose*, 10–60 minims (0.6–3.7 Cc.).

Antagonists and Incompatibles.—The motor excitants and cerebral stimulants are antagonistic. Aqueous preparations, the caustic alkalies, and mineral salts are incompatible.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—The drug is sedative and mildly astringent.

Internally.—Digestive System.—When ingested it excites a sense of warmth in the epigastrium, and in moderate doses increases the secretion of the gastric juice, stimulating the appetite and improving digestion.

Circulatory System.—It differs somewhat from conium in that the heart is slowed by medicinal doses through stimulation of the inhibitory center. The blood-pressure, however, is raised and maintained by stimulation of the vaso-motor center.

Nervous System.—Grindelia possesses considerable hypnotic power. Its effect upon the motor mechanism is similar to that of conium, the muscular weakness affecting first the lower extremities. The sensory nerves are first depressed, there being quite marked cutaneous anesthesia. The drug depresses the reflex mechanism in the spinal cord, so that the reflex movements are greatly lessened: it is said that it also depresses the phrenic nerve.

Respiratory System.—Small doses have little effect upon the respiratory movements; large doses retard the breathing; while toxic doses may produce death through paralysis of the respiratory muscles.

The drug slightly increases the secretion from the pulmonary mucous membrane, and relaxes the circular fibers of the bronchial muscles through depression of the ends of the motor fibers of the vagus distributed to these muscles and of the reflex center in the medulla. The ends of the sensory nerves distributed to the pulmonary mucous membrane are also depressed.

Absorption and Elimination.—Grindelia is readily absorbed, and is eliminated chiefly by the kidneys, increasing the urinary flow, the lungs sharing in the excretory process.

Temperature is unaffected.

Eye.—Large doses cause dilatation of the pupil.

Uterus.—No effect has been noticed.

Untoward Action.—Excepting drowsiness, reduction of cutane-

ous sensibility, slight gastric disturbance, and a feeling of weakness no symptoms have been recorded.

Poisoning.—The drug is feebly toxic; excessive doses, however, act as a gastro-intestinal irritant. The patient is sleepy and complains of muscular weakness; there is a numb or anesthetic condition of the skin, while the pupils are dilated and the pulse and respiratory movements slow and feeble. Should death occur, it will be from paralysis of the muscles of respiration.

Treatment of Poisoning.—The same as in poisoning from conium—diffusible stimulants, strychnine, etc.

Therapeutics.—*Externally and Locally.*—Grindelia is a very efficient application to the skin in *rhus-poisoning*. Indeed, it serves as a soothing lotion in many acute inflammations of the skin, such as *eczema*, etc. The fluid extract used should be well diluted and applied on cloths.

FIG. 9.—Diagram showing how grindelia relaxes spasm of the bronchial muscles in asthma. The sensory nerves (*B*) in the mucous membrane of the bronchial tubes are depressed, so that there is less irritation transmitted to the medulla, to be returned by the motor fibers supplying the bronchial muscles, thus exciting bronchial spasm. The respiratory center (*A*) is depressed, together with the ends of the motor nerves (*C*), limiting the amount of irritation in the bronchial muscles (*E*). The diaphragm (*F*) is relaxed through depression of the phrenic nerve (*D*).

Indolent ulcers are well treated by a diluted solution of the drug. It also serves as an efficient injection in *gonorrhea*, *leucorrhea*, and *vaginitis*.

Internally.—Grindelia has acquired an enviable reputation as a remedy for *spasmodic asthma*, its action upon the bronchial muscles rendering it singularly beneficial in this disorder. It acts upon every possible point to relax the spasm of the bronchial muscles, as is shown in Figure 9. The drug has no influence, however, in preventing a recurrence of the paroxysms.

The drug has been highly recommended in *acute* and *chronic bronchitis*, *hay fever*, *whooping cough*, and in *spasmodic cough* of whatever nature. It has even been suggested as a palliative remedy in *pneumonia* and cardiac and pulmonary *dyspnea*.

There are no special **Contraindications** or directions for **Administration**, save that the fluid extract is pharmaceutically incompatible with aqueous preparations.

Physostĭgma—Physostĭgmatis—Physostigma. *U. S. P.*

(Calabar Bean.)

Origin.—The seed of *Physostigma venenosum* Balfour, a lofty, half-shrubby, climbing plant (somewhat resembling the scarlet-runner or Spanish bean of our gardens) growing near the mouths of the Niger and Old Calabar River in Western Africa, and attaining a height of 40 or 50 feet (12–15 M.).

Description and Properties.—The seeds are about 1 to 1¼ inches (25–30 Mm.) long, ⅜ to ¾ inch (15–20 Mm.) broad, and ⅜ to ⅝ inch (10–15 Mm.) thick; oblong and somewhat reniform; testa granular, chocolate-brown, with a broad black groove extending the entire length of the convex edge; embryo with a short, curved radicle and two large, white concavo-convex cotyledons; inodorous; taste bean-like.

The drug contains an alkaloid, *physostigmine* (also known as *eserine*), which is the principal constituent; *calabarine*, to which the drug owes its tetanizing properties; and *eseridine* (a laxative and motor excitant); besides a neutral principle, *physosterin*, related to cholesterin.

Dose.—1–4 grains (0.065–0.25 Gm.).

Official Preparations.

Extrăctum Physostĭgmatis—Extrăcti Physostĭgmatis—Extract of Physostigma.—*Dose*, $\frac{1}{16}$–$\frac{1}{8}$ grain (0.004–0.01 Gm.).

Tinctūra Physostĭgmatis—Tinctūræ Physostĭgmatis—Tincture of Physostigma.—*Dose*, 5–10 minims (0.3–0.6 Cc.).

The alkaloid, **Physostigmine**, is not official. It occurs in colorless or slightly pinkish crystals; sparingly soluble in water; readily soluble in alcohol.—*Dose*, $\frac{1}{100}$–$\frac{1}{20}$ grain (0.0006–0.003 Gm.). The salicylate and sulphate of physostigmine are official.

Physostigmīnæ Salĭcylas—Physostigmīnæ Salicylātis—Physostigmine Salicylate (Eserine Salicylate). **U. S. P.**

Description and Properties.—Colorless or faintly yellowish, shining, acicular, or short, columnar crystals, odorless, and of a bitter taste; acquiring a reddish tint when exposed to light and air; soluble in 150 parts of water and 12 parts of alcohol. The salicylate should be kept in small, dark amber-colored, and well-stoppered vials.

Dose.—$\frac{1}{120}$–$\frac{1}{30}$ grain (0.0005–0.002 Gm.).

Physostigmīnæ Sŭlphas—Physostigmīnæ Sulphātis—Physostigmine Sulphate (Eserine Sulphate). **U. S. P.**

Description and Properties.—A white, or yellowish-white, micro-crystalline powder, odorless, and of a bitter taste. It is very deliquescent when exposed to moist air, gradually turning reddish in air and light. Very soluble in water and alcohol; still more so at the boiling-point of these liquids. It should be kept in small, dark amber-colored, and well-stoppered vials.

Dose.—$\frac{1}{120}$–$\frac{1}{30}$ grain (0.0005–0.002 Gm.).

Unofficial Preparation.

Physostigmīnæ Hydrobrōmas—Physostigmīnæ Hydrobromātis—Physostigmine Hydrobromate.—*Dose*, $\frac{1}{120}$–$\frac{1}{30}$ grain (0.0005–0.002 Gm.).

Antagonists and Incompatibles.—The action of physostigma upon the heart, respiration, and pupils is antagonized by atropine; that on the spinal cord by chloral; while, in a general way, the motor excitants, particularly the tetanizing agents, are therapeutically antagonistic.

The caustic alkalies and tannic acid are chemically incompatible.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—No external

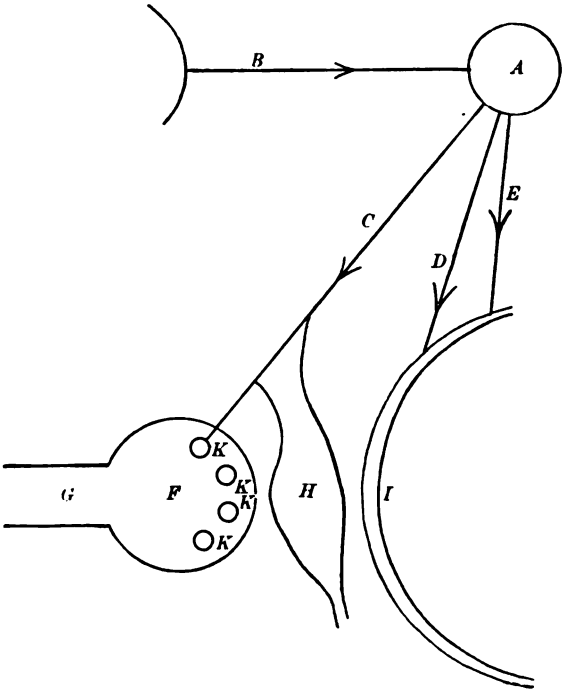

FIG. 10.—Diagram illustrating the mechanism of secretion. An impression is transmitted over the afferent nerve (*B*) to the medulla (*A*), and thence over the secretory nerve (*C*) to the secretory cells (*K*, *K*) of the gland (*F*). At the same time the vaso-motor nerves (*E*) are stimulated, causing a contraction of the arterioles (*I*) supplying the gland; hence, as soon as the lymph in the lymph-spaces (*H*) is consumed, the secretion from the gland is diminished for lack of material necessary to the secretory cells in elaborating their normal secretions.

action of physostigma and its preparations is noted, unless it be its effect upon the pupil, which outward application contracts, and the slight abolition of functional activity in the motor and sensory

nerves, occasioned, it is said, by a strong solution of physostigmine.

Internally.—Digestive System.—The administration of the drug tends to stimulate the salivary, gastric, and intestinal secretions, followed by lessened secretion (see Figure 10), and, by acting upon the muscular coats of the stomach and intestines, to increase peristalsis. Nausea, retching, vomiting, and purging may result. The *rationale* of its action is doubtless direct stimulation of the unstriped muscle-fibers.

Circulatory System.—No influence on the blood has been detected. Small doses increase arterial tension, the heart's action becoming slower and stronger.

Although the effect upon the heart is somewhat obscure, it appears that under poisonous doses the cardiac pulsations are greatly reduced, being slow and feeble, and finally ceasing altogether. It is reasonably supposed that this action is due to primary stimulation of the peripheral vagi, influencing the cardiac ganglia, and also to the effect upon the vaso-motor centers. The subsequent exhaustion and relaxation of the arteries are doubtless the result of a similar influence.

There is marked elevation of blood-pressure under moderate doses, although there may occur a brief period of depression. Toxic doses are accompanied by a notable decrease of arterial tension, the cardiac ganglia being seized with paralysis and the heart finally arrested in diastole.

Nervous System.—As with conium, the mind is comparatively unaffected by physostigma, remaining lucid even to the verge of final collapse. The spinal cord, however, appears to bear the principal shock, the total abolition of reflex activity indicating a selective action of the drug.

To the effect on the motor nerves, occasioning a diminution of power, must be attributed the muscular debility and paralytic symptoms manifest under the administration of toxic doses.

Respiratory System.—No interference with respiration is caused by moderate doses of the drug. Larger amounts primarily depress the respiratory centers, stimulate the peripheries of the pulmonary vagi, and contract the caliber of the bronchial tubes, even to the extent of serious constriction, death usually resulting from asphyxia.

The breathing is first quickened and then retarded, the effect of the drug upon the respiration being more powerful than its circu-

latory influence, the heart continuing to beat for some time after pulmonary action has ceased.

Absorption and Elimination.—The active principles of physostigma and its alkaloids are rapidly diffused in the blood. They are largely excreted by the kidneys, the bile and saliva contributing to the process of elimination, and have been detected in the gastric juices after intravenous injection.

Temperature.—A slight depression has been noted.

Eye.—Applied locally to the conjunctiva or introduced into the circulation, whether by ingestion or injection, physostigmine causes myosis or contraction of the pupil by stimulating the peripheral endings of the oculo-motor nerves, possibly by a depression of the sympathetic fibers.

Other prominent symptoms present are spasm of accommodation and decreased intraocular tension and myopia. Irritation of the third nerve is the principal cause of these phenomena: they have also been attributed to the stimulating action of the drug upon the muscular fibers of the iris rather than to any paralyzing influence upon the sympathetic, pupillar dilatation being manifest under excitation of the latter nerve.

The intraocular pressure is lowered (1) by lessening the blood-supply to the eye through contraction of the blood-vessels; (2) by diminishing the secretion of the aqueous humor from the glands on the surface of the ciliary body; (3) by contracting the iris, so that the aqueous humor can more readily pass through the canal of Schlemm.

Uterus.—The full influence of the drug tends to produce uterine contraction.

Untoward Action.—When eserine is applied to the eye it occasionally produces a nervous contractile pain in the entire eyeball, which extends in a manner similar to ciliary neurosis along the course of the supraorbital nerve, resembling migraine.

Small doses have in some individuals produced nausea and general uneasiness, and occasionally intense pain in the epigastrium.

Poisoning.—Taken in poisonous doses, physostigma causes nausea, giddiness, and muscular tremors and weakness, followed by complete muscular relaxation. Cardiac action is diminished; the reflexes are in abeyance; the respiration is retarded; and myosis and motor paralysis are manifest. The pupils visibly contract, and purging and vomiting may ensue. Fatal results are

possible through paralysis of the respiratory center and consequent asphyxia. The more rapid collapse succeeding the administration of lethal doses is due to cardiac syncope.

Treatment of Poisoning.—The stomach should be evacuated, the process being followed by the hypodermic injection of a solution of atropine, which may prove an efficient physiological antidote. Tannic acid may be used as a chemical antagonist. Diffusible stimulants, such as ether or ammonia, may serve to arrest cardiac and respiratory failure. Digitalis and alcohol have also been successfully employed. Temperature should be maintained by the application of external heat.

Therapeutics.—*Externally and Locally.*—PHYSOSTIGMINE and ESERINE SULPHATE are the preparations usually employed, their only action of importance being in *diseases of the eye.* They are of value in breaking up adhesions of the iris to the cornea or lens, strengthening the muscle of accommodation, reducing intraocular pressure, and removing the effects of atropine, although Jessup claims that *complete* ciliary paralysis by atropine and the mydriasis induced by hyoscine are unaffected by eserine.

In certain cases of *ulcer of the cornea* uncomplicated with iritis and sloughing keratitis, where there is little inflammation or ciliary irritation, eserine sometimes produces prompt improvement when atropine has failed.

Paralytic mydriasis and *paralysis of accommodation* are temporarily relieved by this drug, and weak solutions have been employed with varying success in accommodative *asthenopia* without refractive errors.

The remedy is of unquestioned value in the early stages of *glaucoma*, but only at the commencement of an acute attack and contraindicated in the hemorrhagic form. If the drug fails to contract the pupil when used for glaucoma, it may induce irritating spasm of the ciliary muscles by increasing the blood-supply to the iris.

PHYSOSTIGMINE is sometimes employed to prevent *prolapsus of the iris*, following peripheral perforation of the cornea or cataract extraction, particularly without iridectomy.

The remedy serves a useful purpose also in coal-miners' *nystagmus*, one drop of a collyrium containing ½ grain (0.096 Gm.) of PHYSOSTIGMINE SULPHATE in 1 ounce (30.0 Cc.) of distilled water being dropped into the eye three times a day. Eserine is also employed in *neuralgia of the eyeball* and *photophobia.*

Internally.—PHYSOSTIGMA has proved efficacious in *constipation* due to an atonic condition of the intestines with deficient secretion.

The state of the muscular intestinal layer frequently allows gas to accumulate in the bowels, with consequent troublesome *flatulence*. The drug, by imparting tone to the muscles and increasing peristalsis, greatly relieves this unpleasant condition.

Gastric and *intestinal dilatation* have been successfully treated by Hare with this remedy. It is valuable in *chronic bronchitis* with dilatation of the bronchial tubes, and is said to relieve *bronchial asthma* and *emphysema*.

Progressive paralysis of the insane is sometimes relieved by PHYSOSTIGMA, while its good reputation in *tetanus* is well established. It has been used, but with less favorable results, in *chorea*, *epilepsy*, *infantile convulsions*, and other spasms. Some authorities have recommended it in the treatment of *paraplegia* due to myelitis, *renal hemorrhage*, *night-sweats of phthisis*, and *locomotor ataxia*.

Contraindications.—The same as for conium.

Administration.—The extract or the tincture is usually preferred for internal administration, although the alkaloid fully represents the drug and may be given either by the mouth or hypodermically. For application to the eye the salts of the alkaloid are used. A convenient form of eserine in ophthalmic practice is the medicated gelatin disks.

Aspidospĕrma—Aspidospĕrmatis—Aspidosperma. *U. S. P.*

Origin.—The bark of *Aspidosperma Quebracho-blanco* Schlechtendal, a large evergreen tree, of exceedingly hard wood (Sp. *quebrar*, to break, and *hacha*, an axe), indigenous in the Argentine Republic.

Description and Properties.—Occurring in nearly flat pieces about ½ to 1⅛ inches (12.0–30.0 Mm.) thick; the outer surface yellowish-gray or brownish, deeply fissured, inner surface yellowish-brown or reddish-brown, distinctly striate; fracture displaying two sharply-defined strata of about equal thickness, both marked with numerous whitish dots and striæ arranged in tangential lines; the fracture of the outer lighter-colored layer rather coarsely granular, and that of the darker-colored inner layer short-splintery; inodorous; taste very bitter and slightly aromatic.

Six alkaloids have thus far been isolated from aspidosperma, the most important being *aspidospermine* and *quebrachine*, the former occurring in colorless prismatic crystals insoluble in water and soluble in 48 parts of alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparations.

Extrăctum Aspidospĕrmatis Flūidum—Extrăcti Aspidospĕrmatis Flūidi—Fluid Extract of Aspidosperma.—*Dose*, 5-30 minims (0.3–1.8 Cc.).

Aspidospĕrmine (unofficial).—*Dose*, ¼–½ grain (0.016–0.03 Gm.).

Quebrăchine (unofficial).—*Dose*, 1–2 grains (0.06–0.12 Gm.).

Physiological Action.—*Externally and Locally.*—No important action has been noted.

Internally.—Digestive System.—It is a stomachic, having an action analogous to the vegetable bitters.

Circulatory System.—Aspidosperma depresses the heart, rendering its action slower, with reduction of arterial tension.

Nervous System.—In its action it resembles conium. It depresses the motor mechanism by its influence on the motor centers, and lessens the reflexes through its influence on the spinal cord. Excessive doses cause vertigo and headache, together with paralysis of the extremities, the lower being first affected.

Respiratory System.—Medicinal amounts of aspidosperma retard the breathing, but deepen the inspirations; aspidospermine, on the contrary, increases the respiratory movements. Toxic doses paralyze the respiratory center, death resulting apparently from asphyxia and convulsions.

Absorption and Elimination.—It readily passes into the blood, and is excreted chiefly by the urine, the saliva and sweat sharing in the process of elimination.

Temperature.—It is antipyretic, febrile temperature being reduced by full doses of the drug.

Poisoning.—Aspidospermine is an active respiratory poison, the toxic symptoms being vertigo, headache, free diaphoresis and salivation, great muscular weakness, with paralysis of the lower extremities, slow and weak heart, reduction of temperature, marked depression of the respiration, and death from respiratory failure.

Treatment of Poisoning.—The same procedure is advisable as in cases of poisoning from the other motor depressants.

Therapeutics.—ASPIDOSPERMA is not employed locally, its chief value being in the treatment of *dyspnea* of whatever variety, though it is fair to state that Pluzoldt considers it contraindicated in cardiac dyspnea.

The drug is equal, if not superior, to grindelia in the treatment of *spasmodic disorders of the respiratory apparatus.*

By some clinicians it is claimed to be an efficient remedy in *pneumonia*, being especially useful in relieving cyanosis.

ASPIDOSPERMINE has been highly recommended as an antiperiodic in malaria, and has appeared to modify the symptoms of *acute articular rheumatism.*

Administration.—Both the fluid extract and the alkaloid may be given internally, although a favorite and efficient method of administering the alkaloids is by hypodermic injection.

Sŭmbul—Sŭmbul—Sumbul. *U. S. P.*

Origin.—The root of *Ferula sumbul* (Kauffmann) Hooker fil, a perennial about 8 feet (2.4 M.) high, indigenous in regions north and east of British India.

Description and Properties.—It occurs in transverse segments, varying in diameter from 1 to 3 inches (2–7 Cm.), and in length from 6 to 12 inches (14–30 Cm.); light spongy, annulate or longitudinally wrinkled; bark thin, brown, more or less bristly fibrous; the interior whitish, with numerous brownish-yellow resin-dots and irregular, easily separated fibers; odor strong, musk-like; taste bitter and balsamic. It contains *sumbulic* and *valerianic acids*, a small quantity of volatile oil, and two balsamic resins to which its odor is due.

Dose.—15–30 grains (1.0–2.0 Gm.).

Official Preparation.

Tinctūra Sŭmbul—Tinctūræ Sŭmbul—Tincture of Sumbul.—*Dose*, 15–60 minims (1.0–3.7 Cc.).

The drug has not yet been carefully studied. It is unknown just what substances are incompatible with it, though the motor excitants are probably antagonistic. The exact physiological action is not definitely understood, yet so far as it has been investigated it seems to possess some of the properties of both the motor depressants and antispasmodics, having a sedative action upon the brain and spinal cord.

Therapeutics.—The drug is valuable in the various manifestations of *hysteria*, and has been employed with some success in *ovarian neuralgia* and *dysmenorrhea.*

It is similar to, though not so efficient as, grindelia in *spasmodic coughs.* Indeed, most of the disorders benefited by the antispasmodics yield to the influence of sumbul.

In *neurasthenia* with anemia the extract of sumbul, combined with iron and arsenic, serves a very useful purpose.

Administration.—It may be given in the form of the tincture, or the extract may be administered in pill form.

Vibŭrnum Prunifōlium—Vibŭrni Prunifōlii—Black Haw. *U. S. P.*

Origin.—The bark of *Viburnum prunifolium* L., a tall shrub or small tree 10 to 20 feet (3–6 M.) high, growing in thickets throughout the greater portion of the United States east of the Mississippi.

Description and Properties.—Thin pieces or quills, glassy purplish-brown, with scattered warts and minute black dots; when collected from old wood, grayish-brown, the thin corky layer easily removed from the green layer; inner surface whitish, smooth; fracture short; inodorous; somewhat astringent and bitter.

It contains a bitter principle (viburnin), a bitter resin, valerianic acid, besides tannic, oxalic, citric, and malic acids.

Dose.—30–60 grains (2.0–4.0 Gm.).

Official Preparation.

Extrăctum Vibŭrni Prunifōlii Flūidum—Extrăcti Vibŭrni Prunifōlii Flūidi—Fluid Extract of Black Haw. —*Dose*, ½–1 fluidrachm (1.8–3.7 Cc.).

Antagonists and Incompatibles.—It is chemically incompatible with iron and other substances affected by tannic acid.

Synergists.—Antispasmodics and uterine sedatives.

Physiological Action and Therapeutics.—The action of black haw is not thoroughly understood. It appears to have a sedative action upon the spinal centers, similar in many respects to that of conium. It acts as an antispasmodic, diuretic, nervine, and tonic, being especially useful in various uterine disorders, such as *spasmodic* and *membranous dysmenorrhea.*

The various vaso-motor disturbances and the *menorrhagia* incident to the menopause are frequently relieved by this remedy. It is also of some value in the *prevention of abortion.* Its sedative properties render it serviceable in relieving the severity of *after-pains.*

Contraindications and **Administration** require no special comment or suggestion.

Vibŭrnum Ŏpulus—Vibŭrni Ŏpuli—Cramp Bark. *U. S. P.*

Origin.—The bark of *Viburnum Opulus* L., a small tree 10 to 15 feet (3–4.5 M.) high, indigenous in Canada, the Northern United States, Europe, and Northern Asia.

Description and Properties.—Flattish or curved bands, or occasionally quills, sometimes 12 inches (30 Cm.) long and from $\frac{1}{25}$ to $\frac{1}{16}$ inch (1–1.5 Mm.) thick; outer surface ash-gray, marked with somewhat transversely scattered, elongated warts of a brownish color, due to abrasion, and marked more or less with blackish dots, with black, irregular lines or thin ridges, arranged chiefly in a longitudinal direction; underneath the easily-removed corky layer of a pale-brownish or reddish-brown color; the inner surface dingy white or brownish; fracture tough, the tissue separating in layers; inodorous; taste somewhat astringent and bitter.

Dose.—1–2 drachms (4.0–8.0 Gm.).

Official Preparation.

Extrăctum Vibŭrni Ŏpuli Flŭidum—Extrăcti Vibŭrni Ŏpuli Flŭidi—Fluid Extract of Cramp Bark.—*Dose*, 1–2 fluidrachms (3.7–7.3 Cc.).

The general observations upon Viburnum prunifolium are applicable to this drug.

Ăcidum Hydrocyănicum Dilūtum—Ăcidi Hydrocyănici Dilūti—Diluted Hydrocyanic Acid. *U. S. P.*

(Prussic Acid.)

Origin.—A liquid composed of 2 per cent. by weight of absolute Hydrocyanic Acid and 98 per cent. of Water, prepared by distilling a mixture of Potassium Ferrocyanide, Sulphuric Acid, and Water into Distilled Water.

Description and Properties.—A colorless liquid, of a characteristic odor and taste, resembling those of bitter almonds. *As it is very poisonous, great care should be taken in tasting it.* It should be kept in small, dark-amber colored, cork-stoppered bottles, in a cool place.

Dose.—1–5 minims (0.06–0.3 Cc.).

Antagonists and Incompatibles.—Atropine is a physiological antagonist, the diffusible stimulants also counteracting the effects of the drug. The metallic salts, particularly cobalt nitrate, are chemically incompatible.

Synergists.—The cardiac and motor depressants.

Physiological Action.—*Externally and Locally.*—Applied locally to the unbroken skin, its first effect is slightly irritating, but soon after sedative and anesthetic, because of its influence in causing paralysis of the sensory nerve-endings.

It is very rapidly absorbed from raw surfaces, even toxic effects resulting from its application.

Internally.—Digestive System.—Being quickly absorbed by the mucous membranes, hydrocyanic acid acts as an anesthetic and sedative upon the stomach, moderate doses having little influence upon a healthy organism. Toxic doses may be followed by vomiting and the terribly lethal action of the drug, the peculiarly sudden and violent activity of which renders it the most fatal poison known.

Circulatory System.—Prussic acid passes very readily into the blood, upon which it acts with physical effects variously reported, it having been observed that the blood is at first changed to a bright red or arterial tint, soon changing to a dark venous color. Upon the heart its influence, though in small doses sedative through stimulation of the vagus center, in toxic doses is particularly active, suspending its movements and arresting it in diastole.

A temporary, yet doubtful, increase, followed by a decline, of arterial pressure has been noted. In lethal doses the decrease of tension is unquestionable. Observations upon the physiological effects of prussic acid have been attended with considerable difficulty: a slow and frequently irregular pulse, however, is among the authenticated phenomena. By its action on the respiratory functions of the red blood-corpuscles the supply of oxygen to the circulation is impeded.

Nervous System.—Medicinal doses have no appreciable effect save to occasion a depression of the sensory fibers of the vagus. The cerebral effects of large doses are giddiness and stupor, often accompanied by total insensibility or coma. Toxic doses produce marked cutaneous anesthesia, beginning in the lower extremities, caused by paralysis of the sensory ends and sensory tracts.

The motor mechanism shares in the general influence, which causes excessive muscular weakness, resulting from depression of the spinal motor areas, the ends of the motor nerves, and the muscles respectively.

Respiratory System.—Very small doses of hydrocyanic acid have no effect upon respiration. Full or large doses have been observed

to render the breathing labored and irregular. Under toxic doses the respiration becomes enfeebled, finally ceasing altogether, death ensuing from asphyxia due to paralysis of the respiratory movements by direct action upon the center. It has been noted that lethal doses are so quickly fatal that the respirations cannot be counted.

Absorption and Elimination.—As has been remarked, absorption takes place with great rapidity, elimination being probably through the kidneys, salivary glands, and lungs, the process being accelerated by means of the drug's exceeding volatility. In case of poisoning, should death be averted for half an hour there is chance of recovery.

Temperature.—No special influence has been observed.

Eye.—The pupils are, as a rule, visibly dilated under serious dosage, a temporary hemianopia having been also observed in a case of poisoning with recovery.

Untoward Action.—There are no untoward manifestations save those described under "Poisoning."

Poisoning.—The celerity of action characteristic of prussic acid is evidenced by the fact that death may be instantaneous, the subject falling with a gasp and momentary convulsion, followed by immediate collapse. In such cases the countenance is cyanotic, the teeth firmly set, the eyes wide open, and the lips covered with bloody froth. In less violent cases the symptoms may take the form of reduced respiration, impairment of cardiac movements, and cerebral disturbance. A third stage is marked by wide dilatation of the pupils, loss of consciousness, delirious cries, accompanied by strong convulsions, vomiting, incontinence of urine, involuntary defecation, and even erections of the penis and ejaculations of semen (Hare). In still another stage asphyxia, collapse, and death occur in rapid succession.

Treatment of Poisoning.—Owing to the physical action of prussic acid upon the blood, artificial respiration is generally powerless to avert fatal results (Ringer). Efficient antidotes are ammonia and its carbonate, to be administered whenever practicable. Alcoholic stimuli may prove of service, yet the fearful rapidity of the drug's action renders poisoning by prussic acid rarely amenable to systematic treatment.

A vigorous recourse to alternately warm and cold affusions, together with inhalations of ammonia, has been recommended as of primary importance. Secondary means of allaying toxic effects

may be found in the internal administration of chlorine water or of potassium carbonate, followed by the sulphates of iron.

More recently the subcutaneous injection of atropine has been suggested as the true physiological antidote (Farquharson), while Dr. Antal considers cobalt nitrate the best chemical antagonist. So long as the faintest pulsation is discernible no efforts at recovery should be remitted.

Therapeutics.—*Externally and Locally.*—Hydrocyanic acid is a valuable antipruritic, being frequently employed to relieve the itching of various diseases of the skin, such as *eczema*, *erythema*, *urticaria*, *pruritus vulvæ*, etc. It is commonly applied in strengths of ½ fluidrachm (1.8 Cc.) to 1 ounce (30.0 Cc.) of water.

Inhalations of a solution containing 3 minims (0.18 Cc.) of diluted hydrocyanic acid to 8 ounces (236.6 Cc.) of water at a temperature of 120° F. have been recommended by Mackenzie and others in *asthma* and the *irritative cough of phthisis.*

Internally.—Its sedative properties render the drug an efficient remedy in obstinate *vomiting* and *gastric pain* from whatever cause. It is also valuable to relieve *coughs* of a dry, hacking nature, *whooping cough*, and various neuroses of the respiratory organs. Macdonald reports a case of *night cough* of a child that yielded promptly to hydrocyanic acid after every other treatment had been tried in vain.

The drug has also been employed in *neuralgia* and *acute mania* and *melancholia.*

In *irritable conditions of the heart* it serves as a useful palliative, and it is also of some value in relieving the distress of *irritative dyspepsia.*

Contraindications.—Extreme muscular weakness and the last stages of valvular heart disease.

Administration.—Owing to the exceedingly rapid elimination of prussic acid the dose should be frequently repeated—every hour or two. In the early administration the minimum dose should be first prescribed, the amount being gradually increased to the maximum or until the patient complains of constriction about the throat or other untoward manifestation, when the dosage should be discontinued. Whenever a fresh supply is prescribed it is best to begin with the minimum dose, owing to the variations in strength in the different samples.

Hydrocyanic acid may be given in syrup, water, or glycerin, or in some effervescent draught.

Potăssii Cyănidum—Potăssii Cyănidi—Potassium Cyanide. *U. S. P.*

Origin.—Prepared by heating in an iron crucible a mixture of exsiccated Potassium Ferrocyanide 8 parts and Potassium Carbonate 3 parts until effervescence ceases.

Description and Properties.—White, opaque, amorphous pieces, or a white, granular powder, odorless when perfectly dry, but in moist air exhaling the odor of hydrocyanic acid. The taste is sharp and somewhat alkaline, but should be ascertained with great care, as *the salt is very poisonous.* In moist air it deliquesces; soluble in about 2 parts of water and sparingly soluble in alcohol. Potassium cyanide should be kept in well-stoppered bottles.

Dose.—$\frac{1}{16}$–$\frac{1}{8}$ grain (0.004–0.008 Gm.).

Cyanide of potassium differs from hydrocyanic acid, with which it generally assimilates, in being less rapid in its action, producing dermatitis or eczematous eruption by local application to the epidermis, and in its possibly fatal results from free contact with abraded surfaces.

The **therapeutic** uses are practically those of hydrocyanic acid.

Ămyl Nītris—Ămyl Nitrītis—Amyl Nitrite. *U. S. P.*

Origin.—Obtained by the action of Nitric Acid upon Amylic Alcohol—a liquid containing about 80 per cent. of amyl (principally iso-amyl) nitrite, together with variable quantities of undetermined compounds.

Description and Properties.—A clear yellow or pale-yellow liquid, of a peculiar, ethereal, fruity odor and a pungent, aromatic taste. Almost insoluble in water; miscible in all proportions with alcohol or ether. In alcoholic solution it gradually decomposes, with formation of ethyl nitrite and amylic alcohol. It should be kept in small, dark-colored, glass-stoppered bottles, in a cool and dark place, remote from lights and fire.

Dose.—$\frac{1}{2}$–1 minim (0.03–0.06 Cc.) internally; for inhalation 1–5 minims (0.06–0.3 Cc.).

Antagonists and Incompatibles.—The motor excitants antagonize the action of amyl nitrite.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—Its action is that of a mild irritant when applied to the skin.

Internally.—The following actions apply to ingestion or inhalation of the drug.

Digestive System.—No important action has been observed.

Circulatory System.—Almost immediately after inhalation of amyl nitrite there is a marked flushing of the skin, first perceptible in the face, doubtless occasioned by dilatation of the capillaries. The heart's action is increased and somewhat weakened, and the pulse is soft and compressible. The blood-pressure falls very markedly, the condition being caused by a paralyzing action upon the muscle-fibers found in the walls of the small arterioles, causing marked dilatation. The same cause accounts for the change in the action of the heart, due to diminution of peripheral resistance. Amyl nitrite has no central action.

The inhalation of large amounts renders the heart very weak, toxic doses arresting that organ in diastole. The functional activity of the hemoglobin is checked, giving to the arterial and venous blood a dark chocolate color.

Nervous System.—Among the effects are cerebral oppression, flushing of the head and face, vertigo, headache, and confusion of ideas, with diminished reflex excitability, muscular weakness, and unsteadiness of gait, both the voluntary and involuntary muscles being relaxed. These actions are due to the depressing influence of the drug upon the motor areas of the brain and spinal cord.

Respiratory System.—Small doses quicken the respiration by lowering arterial pressure and possibly by moderate stimulation of the center, due to accumulation of carbon dioxide. Immoderate or toxic amounts render the breathing slow and labored from depression of the respiratory center and arrest of the oxygenating function of the blood.

Absorption and Elimination.—Amyl nitrite is rapidly absorbed, being eliminated chiefly by the kidneys, increasing the amount of urine, uric acid, and urea excreted. Sugar may frequently be detected in the urine, probably resulting from the action of the drug in dilating the hepatic vessels and increasing the circulation in the liver.

Temperature.—Bodily heat is reduced both in health and in fever, due to dilatation of the peripheral blood-vessels and a reduction of the oxygen-carrying power of the red blood-corpuscles.

Eye.—There is marked dilatation of the retinal vessels and hyperemia of the papilla, producing chromatopsia of the parti-colored variety and hallucinations of vision. These effects are usually transitory, and disappear with the elimination of the drug.

Uterus.—The uterine muscle is relaxed.

Untoward Action.—In addition to the symptoms described under "Poisoning," there have been noted gastric disturbance, nausea and vomiting, dryness of the mouth and trembling of the lips, irritation of the throat, defective vision, and subjective sensations of color, usually yellow vision.

Poisoning.—The toxic effects of amyl nitrite include an exceedingly rapid and weak heart, final retardation of the pulse, cyanosis of the face, slow and shallow respiration, cold extremities, subnormal temperature, great muscular weakness, abolished reflexes, vertigo, intense headache, and disordered vision. Death results from cardiac or respiratory failure.

Treatment of Poisoning.—Strychnine and digitalis are required to sustain the heart; ergotin or atropine may be administered subcutaneously, together with cold applications to the head, diffusible stimulants, and artificial respiration if necessary.

Sōdii Nītris—Sōdii Nitrītis—Sodium Nitrite. *U. S. P.*

Origin.—Obtained by heating Sodium Nitrate with Lead, the oxygen from the nitrate being abstracted by the lead oxide formed.

Description and Properties.—White, opaque, fused masses, usually in the form of pencils, or colorless, transparent, hexagonal crystals; odorless, and of a mild, saline taste. When exposed to the air the salt deliquesces and is gradually oxidized to sodium nitrate. Soluble in about 1.5 parts of water; slightly soluble in alcohol. It should be kept in well-stoppered bottles.

Dose.—2–5 grains (0.12–0.3 Gm.).

Spīritus Glonoīni—Spīritus Glonoīni—Spirit of Glonoin. *U. S. P.*

(Spirit of Nitroglycerin.)

An alcoholic solution of 1 per cent. of nitroglycerin.

Origin.—Nitroglycerin is obtained by gradually adding Dehydrated Glycerin to a mixture of Nitric and strong Sulphuric Acid, the nitroglycerin formed being washed with water and dilute soda solution to remove all acid.

Description and Properties.—Nitroglycerin occurs as a clear, colorless liquid possessing the odor and taste of alcohol. It should be tasted and handled with great caution, since it is apt to produce violent headache, whether ingested or applied to the skin. It explodes with great force, and should be kept in a cool place, remote from lights or fire.

Dose.—1–3 minims (0.06–0.18 Cc.) of the spirit.

The actions of sodium nitrite and nitroglycerin are very similar to those of amyl nitrite, although they are less prompt, while more persistent. Nitroglycerin produces a frontal headache of much greater intensity than that caused by amyl nitrite. This is also true of sodium nitrite, though the headache it occasions is less severe than that resulting from nitroglycerin.

Both the sodium nitrite and nitroglycerin are preferable to the amyl nitrite for internal administration.

Therapeutics.—*Externally and Locally.*—The nitrites are not used for external purposes.

Internally.—The property of AMYL NITRITE in suddenly lowering arterial pressure and dilating the arterioles renders it of inestimable value as a relief for the terrible precordial pain in *angina pectoris.*

Epileptic seizures may often be aborted by the instant inhalation of amyl nitrite upon the first indication of the *aura epileptica.* The drug has also been successfully employed for the relief of *asthma,* particularly the uremic form, as well as for *cardiac dyspnea* and *puerperal eclampsia.*

Like many other motor depressants, it has been used in the treatment of *tetanus* and *strychnine-poisoning.* It has proved an efficient preventive for the chill occurring in *virulent malarial fever,* and has served as a valuable antidote in *poisoning from chloroform.*

The drug is indicated in all conditions of high arterial tension, as in *chronic nephritis,* etc. It is also beneficial in *congestive dysmenorrhea.*

The SODIUM NITRITE is used for the same purposes as the amyl nitrite, though superior to it for internal administration, as in cases of abnormally high *arterial tension.*

NITROGLYCERIN is specially adapted for the treatment of *cardiopathies* occurring after middle life. It is useful in chronic nephritis with high arterial tension, and, associated with digitalis, is recommended in certain cases of pneumonia. The tendency to increase of peripheral resistance in the vessels after adult life is attained renders possible the favorable administration of doses of nitroglycerin intolerable in early life.

The drug is often of marked benefit in the *arrhythmia* of slightly enlarged and degenerated hearts with *arterio-sclerosis.* It is also of considerable value in relieving the *pseudo-anginas* which are frequently a feature of vascular disease. It should be given in

doses of $\frac{1}{200}$ to $\frac{1}{100}$ grain (0.00032–0.0006 Gm.) twice or four times daily.

Osler recommends the prolonged administration of nitroglycerin in *locomotor ataxia*, affirming that it lessens the frequency of the crises and relieves the neuralgic pains.

The drug is of use in *sciatica*, and frequently relieves obstinate *hiccough*. It has been recommended for the same diseases for which amyl nitrite is used.

BROMIDES.

Potăssii Brōmidum—Potăssii Brōmidi—Potassium Bromide. *U. S. P.*

Origin.—Prepared by adding Bromine to a solution of Potassa, evaporating to dryness, mixing with Charcoal, heating to redness, dissolving in Water, and crystallizing.

Description and Properties.—Colorless or white, cubical crystals or granules, odorless, with a pungent, saline taste; permanent in air; soluble in about 1.6 parts of water and in 200 parts of alcohol.

Dose.—5–60 grains (0.3–4.0 Gm.).

Sōdii Brōmidum—Sōdii Brōmidi—Sodium Bromide. *U. S. P.*

Origin.—Obtained from a solution of Soda in the same manner as Potassium Bromide.

Description and Properties.—Colorless or white, cubical crystals, or a white, granular powder, odorless, and with a saline, slightly bitter taste. From air the salt abstracts moisture without deliquescing. Soluble in 1.2 parts of water and in 13 parts of alcohol. It should be kept in well-stoppered bottles.

Dose.—10–60 grains (0.6–4.0 Gm.).

Ammōnii Brōmidum—Ammōnii Brōmidi—Ammonium Bromide. *U. S. P.*

Origin.—Obtained by neutralizing Hydrobromic Acid with Ammonia or Ammonium Carbonate, evaporating, and crystallizing.

Description and Properties.—Colorless, transparent, prismatic crystals, or a white, crystalline powder, odorless, and of a pungent, saline taste; permanent in the air. Soluble in 1.5 parts of water and in 30 parts of alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Lĭthii Brōmidum—Lĭthii Brōmidi—Lithium Bromide. *U. S. P.*

Origin.—Prepared by a solution of Ferrous Bromide and Lithium Carbonate, the cool liquid being evaporated and crystallized.

Description and Properties.—A white, granular salt, odorless, and having a sharp, slightly bitter taste; very deliquescent. Soluble in 0.6 part of water and very soluble in alcohol. It should be kept in well-stoppered bottles.

Dose.—5–20 grains (0.3–1.2 Gm.).

Călcii Brōmidum—Călcii Brōmidi—Calcium Bromide. *U. S. P.*

Origin.—Prepared by dissolving pure Calcium Carbonate in Hydrobromic Acid and evaporating.

Description and Properties.—A white, granular salt, odorless, of a sharp, saline taste and very deliquescent. Soluble in 0.7 part of water and in 1 part of alcohol. It should be kept in well-stoppered bottles.

Dose.—10–30 grains (0.6–2.0 Gm.).

Zĭnci Brōmidum—Zĭnci Brōmidi—Zinc Bromide. *U. S. P.*

Origin.—Prepared by digesting Granulated Zinc in Hydrobromic Acid, concentrating the solution, acidulating with Hydrobromic Acid, and drying upon a water-bath.

Description and Properties.—A white, granular powder, odorless, and having a sharp, saline, and metallic taste. Very deliquescent. Readily soluble in water and alcohol.

Dose.—1–5 grains (0.06–0.3 Gm.).

Strŏntii Brōmidum—Strŏntii Brōmidi—Strontium Bromide. *U. S. P.*

Origin.—Obtained by neutralizing Hydrobromic Acid with Strontium Carbonate, filtration, and evaporation.

Description and Properties.—Colorless, transparent, hexagonal crystals, odorless, and having a bitter, saline taste. Very deliquescent. Soluble in 1.05 parts of water and readily soluble in alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Ăcidum Hydrobrōmicum Dilūtum—Ăcidi Hydrobrōmici Dilūti—Diluted Hydrobromic Acid. *U. S. P.*

Origin.—A liquid composed of 10 per cent. by weight of Absolute Hydrobromic Acid and 90 per cent. of Water.

Description and Properties.—A clear, colorless liquid, odorless, and having a strongly acid taste. Miscible in all proportions with water and alcohol. It should be kept in glass-stoppered bottles, protected from light.

Dose.—20 minims–2 fluidrachms (1.23–7.39 Cc.).

Bromofŏrmum—Bromofŏrmi—Bromoform (Unofficial).

Origin.—Obtained by the action of Bromine upon equal parts of Methylic Alcohol and Caustic Potash.

Description and Properties.—A colorless, limpid liquid with an agreeable odor and sweet taste. Insoluble in water, but soluble in alcohol and ether. It should be kept in well-stoppered, dark, amber-colored bottles.

Dose.—1–5 minims (0.06–0.3 Cc.).

Antagonists and Incompatibles.—The bromides are antagonized by the motor excitants and cardiac stimulants. The incompatibles are acids, acidulous and metallic salts. Spirit of nitrous ether is incompatible with the ammonium bromide.

Synergists.—Their action upon the brain is enhanced by opium and the hypnotics, while the cardiac depressants increase their effect upon the circulatory system.

Physiological Action.—The action of potassium bromide is here given, that being the type of the group: later the comparative actions of the various members will be considered.

Externally and Locally.—Potassium bromide is slightly sedative to mucous membranes when applied locally, lessening the reflex irritability, particularly of the pharynx.

Internally.—Digestive System.—No effect is produced by moderate amounts. Excessive doses have occasioned a sense of coldness in the epigastrium, with nausea and looseness of the bowels.

Circulatory System.—The bromides depress the circulation, causing the pulse to become slower, softer, and weaker, and shortening the systole while prolonging the diastole of the heart. The caliber of the vessels is diminished, although arterial pressure is

lowered. Arterial anemia of the brain is present, owing to the contraction of the blood-vessels and diminished arterial pressure. Toxic doses of potassium bromide cause dilatation of the heart and paralysis in diastole.

The exact points where the bromides act to cause this circulatory depression are undetermined.

Nervous System.—When given for a long time or under large dosage the bromides depress the cerebral cells, producing somnolence, reducing the excitability of the brain, and, if long continued, impairing the memory and intellect.

Under their influence there is marked depression of the motor mechanism, resulting in muscular weakness. Every possible point of the apparatus is depressed—the cerebral and spinal motor areas, the spinal motor tracts, the ends of the motor nerves, and even the muscles themselves.

Bromides also lessen greatly the reflex excitability of the spinal cord. As in their action upon the motor mechanism, they depress every part of the reflex apparatus—the ends of the afferent and efferent nerves and the reflex center wherever it may be.

The sensory mechanism is therefore impaired, causing diminished sensibility of the skin and mucous membranes.

The functional activity of the sexual organs is considerably lessened by these drugs.

Respiratory System.—Under full doses the respirations are slower and shallower, owing to depression of the respiratory center, paralysis of which usually causes death, although fatal paralysis may affect the heart because of the poisonous influence of the potassium upon the cardiac muscle.

Absorption and Elimination.—The bromides are very rapidly absorbed, having been found in the urine ten minutes after their ingestion (Dujardin-Beaumetz), and are quickly eliminated, chiefly by the kidneys, increasing the flow of urine, and also by the skin, saliva, intestinal and mammary glands, and the bronchial mucous membrane. The sulphur and nitrogen in the urine are increased and the amount of phosphorus decreased.

Notwithstanding the rapid elimination of the bromides, under prolonged administration they tend to accumulate in the system, being found abundantly in the nerve-centers.

Temperature.—Immoderate doses cause a reduction of temperature, due to depression of the circulation and lessening of tissue-change.

Eye.—There may occur dilatation of the pupil, conjunctival catarrh, diplopia, amblyopia, dimness of vision, and dilatation of the retinal blood-vessels.

Uterus.—A diminution of the catamenia may sometimes be present.

Untoward Action.—The susceptibility of individuals to the untoward action of the bromides is extremely variable. The symptoms observed are—gastric uneasiness with eructation, nausea and vomiting, analgesia of the epiglottis and pharynx, bronchial catarrh, hoarseness and cough, acute coryza and conjunctivitis, offensive breath, dysuria, diminished sensibility of the genito-urinary mucous membrane, and a variety of cutaneous eruptions.

Poisoning.—Bromism, as the symptoms of poisoning are termed, may be divided into acute and chronic.

Acute bromism, resulting from a single toxic dose, is manifested by violent frontal headache, great muscular weakness, incoördination of movements, abolition of reflexes, somnolence, slow and shallow breathing, subnormal temperature, lustreless eyes, and very slow and weak pulse, death resulting from either respiratory or cardiac failure.

Chronic bromism, caused by prolonged use of the bromides, is characterized by mental apathy, constant drowsiness, hallucination or melancholia, considerable cutaneous anesthesia, muscular weakness, poor circulation, cold extremities, marked anemia, impairment of the sexual function, deranged digestion, and cutaneous eruptions of various forms collectively designated as "bromine acne."

Treatment of Poisoning.—The drug should be immediately withdrawn and methods adopted to hasten elimination, such as the administration of diuretics, cathartics, etc. Tonics, such as strychnine, iron, and the cardiac stimulants, should be given, while exercise and change of scene may counteract the psychical symptoms.

It is claimed that the daily administration of Fowler's solution causes a rapid disappearance of the bromine eruption.

Comparative Action of the Bromides.—POTASSIUM BROMIDE contains 66 per cent. of bromine. It is the least hypnotic and most toxic to the heart and muscular system.

SODIUM BROMIDE, 78 per cent. of bromine, is more hypnotic, but much less toxic, than the potassium salt. Its effect upon the circulation is the most pronounced of all the bromides.

AMMONIUM BROMIDE is less toxic and more stimulating than potassium bromide, though resembling it in other respects.

LITHIUM BROMIDE is the richest in bromine, containing 92 per cent., and is probably the most hypnotic of all. Its action more nearly resembles that of the sodium salt.

CALCIUM BROMIDE, while resembling them in its action, is less energetic than the other bromides.

ZINC BROMIDE is the most irritant, and is supposed to possess both tonic and sedative properties.

STRONTIUM BROMIDE is the mildest of all, being less prone to cause bromism.

DILUTED HYDROBROMIC ACID in its action resembles the bromides, though much less depressant than the potassium salt, and less likely to occasion symptoms of chronic poisoning.

Therapeutics.—*Externally and Locally.*—*Pharyngitis* is relieved by a gargle containing POTASSIUM BROMIDE and potassium chlorate. A solution of potassium bromide diminishes the sensibility of the throat, so that examinations are more easily made. A solution of 4 parts of potassium bromide in 20 parts of glycerin affords a soothing lotion in painful *hemorrhoids*. It is asserted that the powdered salt has been dusted over indolent *ulcers* with benefit.

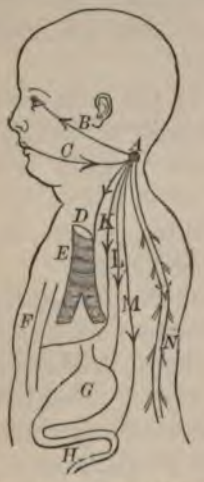

FIG. 11. — Diagram showing how irritation of the dental nerve in teething, by stimulating the sensitive reflex mechanism of the infant, may produce strabismus (*B*), cough (*D*, *K*), indigestion (*L*), diarrhea (*M*), and convulsions (*N*).

Internally.—The BROMIDES are especially useful in allaying excessive brain activity, the *insomnia* (particularly the sleeplessness dependent upon nervous excitement, exhaustion, and irritability) and *headache of cerebral congestion* yielding readily to these remedies.

They are undoubtedly the most efficient medicinal agents for the relief of *epilepsy*, being given either alone or in combination with some vegetable bitter. Fêré combines with them an intestinal antiseptic, asserting that the union lessens the tendency to bromism. Bechterew highly recommends a combination of the bromides with Adonis vernalis.

Being such marked depressants of the reflex centers, they are of decided benefit in nervous spasmodic disorders, and particularly valuable in *infantile convulsions*.

During dentition children suffer from various disturbances due to irritation of the dental nerve—*convulsions*, *cough*, *indigestion*, *diarrhea*, *strabismus*, etc.—in all of which the bromides, being

powerful depressants of the reflex mechanism, prove of great value. (See Diagram 11.)

Whenever there is increased reflex excitability the bromides are indicated. They are therefore valuable in the *reflex disturbances of the menopause*, *spasmodic asthma*, *laryngismus stridulus*, *whooping cough*, and other *coughs* of reflex origin. They have also been used in *tetanus* and *strychnine-poisoning*.

Excessive *nervous irritability* is quickly relieved by these remedies, either singly or in combination with some of the antispasmodics, such as asafetida, valerian, etc.

Because they depress the sexual mechanism they are of decided benefit in *spermatorrhea* of the plethoric or in the condition arising from irritation of the deep urethra. *Menorrhagia* resulting from excessive ovarian excitement is frequently relieved by these agents, while *nymphomania* and *delirium tremens* are often greatly benefited by full doses of the bromides.

The AMMONIUM BROMIDE has been employed with benefit, it is said, in *diabetes* of nervous origin. *Cerebral vomiting* and the *vomiting of pregnancy* are sometimes singularly amenable to the influence of the bromides.

The author is quite partial to a combination of SODIUM BROMIDE, spirit of nitrous ether, and tincture of aconite, in anise water, as a remedy in *acute febrile attacks* of children with delirium. Small doses are given at frequent intervals until there is a decided improvement in the symptoms.

The bromides are claimed to be of value in *acute* and *muscular rheumatism*. The LITHIUM SALT is undoubtedly of service in these cases and in the *uric-acid diathesis*.

The sedative action upon the circulatory apparatus exerted by the bromides renders them valuable in *cardiac irritability* when not due to anemia. They are particularly useful in quieting the heart's action in *exophthalmic goiter*.

Augagneur advises the use of the bromides together with the iodides in the treatment of *syphilis*, believing that their administration prevents such untoward manifestations as *dysphonia*, *aphonia*, or *dyspnea* in laryngeal syphilis.

The STRONTIUM BROMIDE is highly recommended in *fermentative dyspepsia* due to decomposition of food.

BROMOFORM ranks to-day superior to all other remedies in the treatment of *whooping cough*, an overwhelming amount of authoritative evidence tending to prove that the drug not only greatly

curtails the duration of the disease, but mitigates the severity of the paroxysms and renders them less frequent.

Bromoform has also been highly recommended in *acute mania* and *delirium tremens.*

DILUTED HYDROBROMIC ACID is used for the same purposes as the bromides, some clinicians preferring it to the latter to quiet the *delirium of simple continued fevers.* It is employed extensively to relieve the symptoms of *cinchonism.*

Contraindications.—The bromides are contraindicated in conditions of great debility, anemia, or fatty or weak heart with low arterial pressure.

Administration.—The bromides should be given in solution, and when long continued, as in the treatment of epilepsy, they should be accompanied by restorative agents. Carbonated waters, milk, and aromatic elixir serve as efficient vehicles to disguise the taste of these salts.

Children acquire a remarkable tolerance for the bromides, so that large doses may be given them with but little danger.

Bromoform may be dropped into a spoonful of water and administered in this simple manner, or it may be dissolved in glycerin. P. W. Bedford has originated a formula which makes an exceedingly palatable and perfect solution:

Bromoformi,	ℳxvj (1.0 Cc.);
Alcoholis,	
Tincturæ Cardamomi Compositæ,	āā. fʒij (7.39 Cc.);
Glycerini,	q. s. ad. ℨij (60.0 Cc.).

Each fluidrachm contains 1 minim (0.06 Cc.) of bromoform.

The diluted hydrobromic acid should be given in water or syrup.

GROUP VIII.—CARDIAC STIMULANTS.[1]

CARDIAC remedies may be divided into *Cardiac Tonics, Cardiac Stimulants,* and *Cardiac Sedatives* or *Depressants.* The grouping is a rational one, both from a clinical and a physiological point of view, although the Cardiac Sedatives are at present much more

[1] The author is indebted to Joseph M. Patton, M. D., Professor of Medicine in the Chicago Policlinic, for valuable assistance in preparing the present group, his observations on therapeutics being occasionally cited *verbatim.*

limited in their clinical application than they were a few years ago, being used principally in sthenic fevers with excessive cardiac action.

Cardiac Tonics.—By these are implied those drugs which add tone to the cardiac muscle and the nervous mechanism of the heart, increasing the nutrition of that muscle, and consequently augmenting its capacity for work.

The cardiac tonics have little or no effect upon the dynamic force exerted through the contraction of the heart-muscle, herein lying their essential distinction from cardiac stimulants, which affect *per se* the muscular contractile force.

The proper period for the employment of cardiac tonics anticipates that where the exhibition of cardiac stimulants becomes necessary. They are, moreover, prophylactic against the latter contingency, preventing the development of a hyposystolic condition of the heart. They are also indicated subsequent to the temporary use of cardiac stimulants to improve the nutrition of the heart and maintain the beneficial results of stimulation.

Cardiac tonics should be given in small doses and the administration prolonged.

The principal members of the group are—STRYCHNINE, the IODIDES, ARSENIC, and IRON, to which should be added MERCURY in small doses. The most useful are strychnine and the iodides, and they are well adapted for combined administration.

Since most cases requiring the exhibition of this class of remedies occur after middle life, they are especially benefited by the action of STRYCHNINE on the cardiac nervous system and the increased nutrition to the heart-muscle through the effect of the IODIDES on the smaller vessels. The progressive tendency of after-lifetime toward loss of elasticity and a contraction of the smaller arteries is opposed by the action of the iodides in dilating these vessels.

The advantage of prolonged administration of MERCURY in small doses in chronic cardiopathies during or after middle life is probably due to the stimulating effect of the drug on the functions of elimination.

MERCURY is adapted to nearly all senile cardiopathies, particularly in conditions of general vascular sclerosis, the most desirable form being the BICHLORIDE or RED IODIDE in doses of $\frac{1}{64}$ grain (0.001 Gm.) three times daily.

ARSENIC may be used in the form of the ARSENIC IODIDE or as

FOWLER'S SOLUTION. It is of special value in anemic conditions associated with cardiopathies in young persons.

The most eligible form of IRON for cardiac patients, especially after middle life, when elimination is an important consideration, is the LIQ. FERRI ET AMMONII ACETATIS (Basham's mixture), or the so-called TASTELESS TINCTURE OF IRON, with which the tincture of nux vomica may be well combined.

The physiological action and further medical uses of these cardiac tonics are more fully described under their respective heads.

Cardiac Stimulants.—As cardiac stimulants are designated those drugs endued with the specific property of lengthening and invigorating the contraction of the cardiac muscle. This effect would necessarily be more or less temporary, and, while some permanent benefit may be derived from improved nutrition resulting from a better blood-supply afforded by these agents, they are adapted only for passing administration and are not true cardiac tonics.

The general indication for the employment of this class of remedies rests in the presence of dynamic insufficiency of the muscle, which may be either actual or relative, as is the case of increased peripheral resistance to the blood-current. In the latter instance it is evident that the extracardiac obstruction must be removed before the salutary effects of cardiac stimulants can be obtained.

It is in actual failure of the contractile force of the cardiac muscle that these stimulants display their most beneficial influence. This failure is due to a greater quantity of blood in the cavity than the muscle is able to cope with. The amount of dynamic force required at each contraction to expel this quantity is so great that the muscle is unable to withstand the pressure without stretching, and consequently dilatation is developed. Here the favorable action of cardiac stimulants is manifest, since by stimulating the muscle to more vigorous contraction the equilibrium of the circulation is maintained until compensatory increase in muscular power has had time to develop.

The principal cardiac stimulants are—DIGITALIS, STROPHANTHUS, CAFFEINE, ALCOHOL, AMMONIA, SPARTEIN, CACTUS GRANDIFLORA, ADONIS VERNALIS, and CONVALLARIA, all fully described under their respective heads.

In addition to these, STRYCHNINE, OPIUM, and NITROGLYCERIN are

sometimes used as cardiac stimulants. They are fully described under their respective heads.

DIGITALIS is the typical medicament of the group, after many years still retaining its place as the most trustworthy and generally useful cardiac stimulant.

Digitālis—Digitālis—Digitalis. *U. S. P.*

(FOX-GLOVE.)

Origin.—The leaves of *Digitalis purpurea* L., collected from plants of the second year's growth. The plant is a biennial, 2–5 feet (0.6–1.5 M.) high, indigenous in Southern and Central Europe, and growing wild as far north as Norway. It is also found in Madeira and the Azores, and is well known everywhere as an ornamental garden plant.

Description and Properties.—From 4 to 12 inches (10–30 Cm.) long, ovate or ovate-oblong, narrowed, with a petiole, crenate, dull green, densely and finely pubescent, wrinkled above, paler and reticulate beneath, midrib broad near the base; odor slight, somewhat tea-like; taste bitter, nauseous. The leaves of mullein, *Inula coryza* and *Inula helenium*, are sometimes mixed with those of fox-glove.

It is yet undecided what the chief constituents are. Five principles, however, have been isolated, neither of which represents the crude drug. They are—*digitalin* (soluble in alcohol, insoluble in water); *digitalcin* (soluble in water and alcohol); *digitonin*, the most active diuretic principle (soluble in water, insoluble in alcohol); *digitin*, an inert substance; and *digitoxin*, the most active constituent (insoluble in water and sparingly soluble in alcohol). All save digitoxin are glucosids.

Dose.—$\frac{1}{2}$–2 grains (0.03–0.12 Gm.).

Official Preparations.

Extractum Digitālis—Extracti Digitālis—Extract of Digitalis.—*Dose*, $\frac{1}{8}$–$\frac{1}{2}$ grain (0.01–0.03 Gm.).

Extractum Digitālis Flūidum—Extracti Digitālis Flūidi—Fluid Extract of Digitalis.—*Dose*, ½–2 minims (0.03–0.12 Cc.).

Infūsum Digitālis—Infūsi Digitālis—Infusion of Digitalis (1½ per cent.).—*Dose*, 1–4 fluidrachms (3.7–15 Cc.).

Tinctūra Digitālis—Tinctūræ Digitālis—Tincture of Digitalis (15 per cent.).—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Unofficial Preparations.

Digitalīnum—Digitalīni—Digitalin.—*Description and Properties.*—An amorphous, yellowish-white, crystalline powder or scales, or light, white crystalline tufts of

needles, odorless and of an intensely bitter taste. Insoluble in water, soluble in alcohol.

Dose.—$\frac{1}{100}$–$\frac{1}{30}$ grain (0.0006–0.002 Gm.).

Digitŏxin—Digitŏxin—Digitoxin.—*Description and Properties.*—A white, crystalline body, of a bitter taste; insoluble in water, soluble in chloroform.

Dose.—$\frac{1}{200}$–$\frac{1}{100}$ grain (0.0003–0.0006 Gm.).

Antagonists and Incompatibles.—The most complete antagonist is saponine, the active constituent of *Saponaria officinalis*. The cardiac depressants antagonize the action of digitalis upon the heart, morphine and the emetics possessing a similar property, though in less degree.

The incompatibles are the ferric chloride and sulphate, preparations of cinchona, tannic acid and preparations containing it, and the subacetate and acetate of lead.

Synergists.—The cardiac action of digitalis is aided by other members of the group (cardiac stimulants), and also by belladonna and ergot.

Physiological Action.—*Externally and Locally.*—Digitalis possesses mild sedative properties when locally applied, and is readily absorbed by the skin.

Internally.—Digestive System.—Small doses ordinarily produce no effect upon the stomach. Large doses act as a gastro-intestinal irritant, exciting nausea, vomiting, and diarrhea. These effects may follow the prolonged administration even of small doses.

Circulatory System.—The principal effects of digitalis are upon the circulatory apparatus, the action of the drug varying according to the size of the dose. Medicinal doses cause the pulse to beat stronger, firmer, and slower, the strength of the beat being due to stimulation of the cardiac ganglia and the muscular fibers themselves. Arterial pressure is raised through stimulation of the vasomotor center in the medulla and the ganglia situated in the muscular coats of the blood-vessels, causing a contraction both of the arteries and arterioles.

This increase of arterial tension gives firmness to the pulse-beat: its slowness is due to lessened frequency in the heart-beat, caused by stimulation of both the roots and ends of the cardiac vagus, and consequent lengthening of the diastolic period.

Large doses may cause the pulse to beat faster and still increase arterial pressure. The rapid cardiac action is due to over-stimulation of the pneumogastric nerve and consequent exhaustion. The inhibition being removed and the heart acting under the influence

of the sympathetic nerves, its beats are more frequent. The arterial tension is still high, because the mechanism presiding over the caliber of the arterioles is not so easily over-stimulated as the vagus, and contracts still more, which, with the increased action of the heart, tends to increase arterial tension.

Toxic doses render the pulse very rapid, irregular, soft, and weak. The irregular action of the heart is due to exhaustion of the motor ganglia in the heart-muscle from over-stimulation, one of the functions of these ganglia being to induce regular cardiac contraction.

The pulse is soft because of lowered arterial pressure, the arterioles under these doses being dilated from exhaustion of the vaso-motor mechanism. The weak pulse is due to exhaustion of the muscular power of the heart from over-stimulation. Death usually occurs with stoppage of the heart in diastole.

Nervous System.—No effect is produced by medicinal doses. Immoderate doses, however, occasion headache and vertigo, together with lessened reflex activity—by stimulating Setchenow's inhibitory center and depressing the motor nerves. The muscles themselves may be paralyzed, the sensory nerves being unaffected.

Respiratory System.—Medicinal doses have no effect upon the system; toxic doses slow the respiration.

Absorption and Elimination.—Digitalis is more rapidly absorbed than eliminated, the elimination probably taking place by the kidneys, under certain conditions increasing the urinary flow, and many authorities claim that the amount of solids excreted is augmented, except urea and uric acid, which are diminished.

Its diuretic action is due to the increase of blood-pressure in the glomeruli of the kidneys, being therefore more pronounced in conditions of low arterial pressure. Very large doses, instead of increasing the amount of urine, may diminish or even wholly suppress it.

The action of digitalis upon the kidneys is elucidated by the diagram (Fig. 12).

It is claimed that two constituents of digitalis, digitoxin and digitalein, dilate the renal arteries, while digitalin has no effect upon the renal blood-vessels, but contracts those of the general system.

The true action of digitalis, however, is as yet undetermined. It is an extremely complex drug, and its various constituents pos-

sess different properties when therapeutically employed. It is obvious, therefore, that the action upon the heart and kidneys will depend largely upon the particular preparation administered.

Temperature.—Medicinal amounts have no appreciable effect

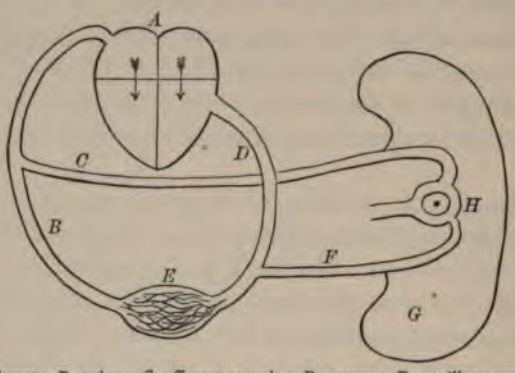

FIG. 12.—*A*, heart; *B*, veins; *C*, efferent vessels; *D*, artery; *E*, capillary system; *F*, afferent vessels; *G*, kidney; *H*, glomerules of the kidney.

upon the temperature; large doses cause a reduction of bodily heat in febrile conditions, while toxic doses reduce temperature even in health.

The action of digitalis upon the circulatory system is retarded by high temperature.

Eye.—Medicinal amounts have no effect. Large or poisonous doses may cause dimness of vision, amblyopia, diplopia, or mydriasis. In a case of poisoning by digitalis recorded by Jeanton there was xanthopsia for two days.

Uterus.—Large doses stimulate contraction in the uterine muscles.

Untoward Action.—Erysipelatous and papular eruptions have been produced by the drug, there having been also observed nausea and a feeling of weakness in the stomach, dimness of vision, headache, heaviness of the head, sleeplessness, and debility.

Poisoning.—Toxic symptoms may occur either from the ingestion of a single poisonous dose or the accumulation of the drug under prolonged administration. There are marked disturbances of the gastro-intestinal tract, abdominal pains, vomiting and purging, a rapid, irregular, and compressible pulse—often imperceptible at the wrist—and syncope, more frequently occurring when the patient is raised up.

Other symptoms are—feeble respiration, dilated pupils and occasionally double vision, headache, delirium and stupor, and

possibly convulsions just before death, which occurs from cardiac failure. Digitalis is not a rapid poison, the fatal collapse being usually deferred from ten to forty-eight hours.

Treatment of Poisoning.—Lavage of the stomach should be immediate, emetics being too depressing if the heart is already affected by the poison. A solution of tannic acid should be introduced into the stomach as the best chemical antidote. Diffusible stimulants may be required, the horizontal position should be maintained, and external heat applied, particularly to the abdomen.

Saponin, aconite, and opium are physiological antidotes, and one or more of them should be employed.

Therapeutics.—*Externally and Locally.*—Poultices made of DIGITALIS LEAVES have been employed with some success in *acute inflammation of the joints*, and when applied over the loins act as an efficient sedative and diuretic in *congestion of the kidneys.*

Internally.—DIGITALIS is one of the most important drugs known to medicine. The remedy is indicated in deranged conditions of the circulatory system itself, and, moreover, where, although the circulatory mechanism be normal, an abnormal state of other organs may be improved by changing the circulation in them. Digitalis is indicated in any case where there is actual failure in the dynamic power of the heart-muscle, irrespective of the nature of any primary valvular lesion inducing the hyposystolic condition.

Of course the rational use of the drug presupposes the absence of extensive fatty degeneration or interstitial myocarditis, since, should these conditions be advanced, there is danger of producing permanent asystole. It is difficult to estimate the integrity of the heart-muscle, and many cases presumably intolerant of the drug bear digitalis well.

There has been considerable objection to the use of digitalis in cardiac ataxia resulting from *aortic regurgitation*, on the ground that the latter action is more forcible and extensive under its influence.

This argument is generally advanced by those who believe that the dilatation of the left ventricle in aortic regurgitation is due mainly to the effect of the counter-current upon the relaxed ventricle while in diastole. The regurgitant stream has probably little or no influence in producing the dilatation, since the cubic area of the ventricular cavity covered by the stream is so much greater than that of its inlet that it is difficult to see how great pressure could be exerted in this way. The phenomenon is, rather,

mainly due to the greater pressure necessary to empty the ventricle of its superfluous blood.

That there is any marked increase in the amount of regurgitated blood through reduced action of the heart is not sustained by the clinical results of the administration of digitalis in cases of aortic regurgitation. Indeed, they respond to the use of the drug as promptly as any other lesion, save that it is at times necessary to give larger doses, often twice the quantity administered in other valvular lesions.

As to the cumulative effect of digitalis, so much feared by the older writers on its action, the evil may be ascribed to improperly selected cases or faulty administration. Under proper conditions the drug may be given for months without ill effect.

It is asserted that the action of digitalis may be manifested for some time upon discontinuance of a brief dosage.

With regard to the specific effect of the drug upon the heart-muscle this is not true, since the influence of the drug lasts but a few days, indirectly, through the additional muscle-power developed during a few weeks' administration. During or after middle life, if the vascular tension be increased, and especially if there be any sclerosis of the vessels, the administration of digitalis should be combined with that of vaso-dilators, to prevent contraction of the vessels and consequent increase of peripheral resistance. Of these adjuncts, opium is generally the most useful, from 2 to 5 drops (0.1–0.3 Cc.) of the deodorized tincture or $\frac{1}{20}$ to $\frac{1}{12}$ grain (0.003–0.005 Gm.) of morphine sulphate being given (Patton).

In *mitral regurgitation* digitalis is an exceedingly efficient remedy. As shown in the diagram (Fig. 13), there is a deficiency of blood in the systemic arteries, and consequently an over-accumulation in the pulmonary vessels and systemic veins. Owing to this venous hyperemia, there is congestion of the lungs, stomach, liver, and the entire digestive tract, together with the attendant symptoms—dyspnea, bronchitis, deranged digestion, constipation, edema, etc.

Digitalis by improving the pumping power of the heart equalizes the circulation, fills the systemic arteries, and relieves the venous congestion with its accompanying symptoms.

Digitalis is valueless in the presence of compensatory hypertrophy, but after *dilatation* occurs is wonderfully effective, the size of the heart being often perceptibly diminished by a proper administration of the drug.

Digitalis may act indirectly as a tonic by improving the nutrition of the heart through the prolonged diastole and contraction of the cardiac muscle it occasions. The longer the period of diastole, the more time is allowed for the coronary arteries to fill and nourish the heart by the better blood-supply. The increased arterial tension produced by the drug causes the blood to be sent into the coronary arteries with greater force during the cardiac diastole.

The forcible contraction of the heart occasioned by this drug expels the blood from the veins of the cardiac muscle, improved nutrition of the muscle resulting from this mechanical action.

The prolonged diastole produced by digitalis allows the heart to rest, conserving its energy and rendering the drug of great value in many acute diseases accompanied by excessive cardiac action.

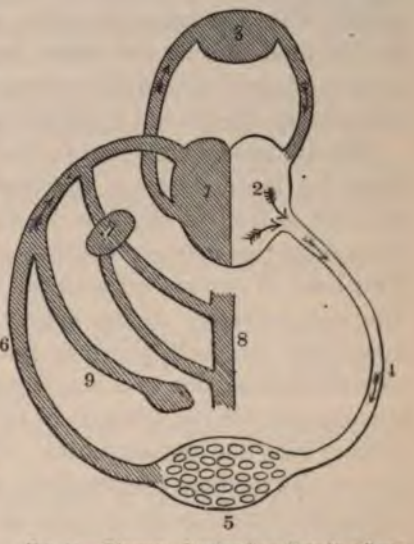

FIG. 13.—Diagram showing how digitalis relieves the symptoms of mitral disease: 1, right heart; 2 left heart; 3, lungs; 4, systemic arteries; 5, capillaries: 6, systemic veins; 7, liver; 8, intestines; 9, lymphatics.

In many valvular diseases of the heart there is marked irregularity, an irritability in its action being often more serious than the mere leakage of blood. Digitalis by stimulating the vagus and motor ganglia reduces the irritative influence, causing the heart to beat more regularly. The drug is therefore of great service in *exophthalmic goiter*.

In any condition of low arterial tension, whether resulting from *hemorrhage*, *general debility*, or whatever cause, digitalis by increasing the force of the heart and raising arterial pressure serves a useful purpose.

In *collapse from shock*, *poisoning*, or *cholera*, where the great veins are dilated, it has proved an efficient agent.

The functional activity of the various organs in *anemia* and other deranged conditions of the system may be improved by the administration of this remedy.

The circulation being improved, there is increased absorption

of fluid from the tissues, as well as greater circulation of fresh intercellular fluid, favoring combustion and functional activity, while the waste products are more readily removed. This action renders digitalis valuable as a tonic.

In the *second stage of pneumonia* it is of the greatest importance, being of use here to stimulate the contractile force of the cardiac muscle when the intraventricular pressure becomes stronger than the unaided muscle can resist, and dilatation is imminent if not already begun. The main indication for the drug is the increase in intensity of the second pulmonic sound.

Maragliano recommends the neutralization of the pneumococcus toxin by large doses of digitalis. On the first day the patient receives 4 Gm. of digitalis in an infusion, and if the case is a severe one this may be repeated in the second twenty-four hours. This dose is diminished with the pulse-frequency. Usually 12–16 Gm. are necessary in the course of a pneumonia. While these large doses are well borne by pneumonia cases, they are injurious to well persons, due to a neutralization of the pneumonia toxin by the digitalis, for the addition of 1½ Cgm. of digitalin to 10 Gm. of a culture kills the pneumococci. Even the addition of 3 Mg. to 10 Gm. of the medium hinders their development. This action seems to be specific, since the growth of other organisms, as the typhoid or cholera bacilli, or the streptococcus pyogenes, is uninfluenced.

In *congestion of the lungs* during the course of *exhausting fevers*, such as *typhoid*, and in the first stage of *meningitis*, *bronchitis*, *cellulitis*, etc. before transudation takes place, it is considered by many physicians to be a valuable remedy in relieving the venous stasis.

Digitalis is singularly beneficial in *scarlet fever* to slow the heart and by its action upon the kidneys prevent renal complications.

Mr. Jones was among the first to recommend large doses of digitalis in *delirium tremens*. The author has found it to be wonderfully effective in this condition, particularly where there is low arterial pressure, at the same time having observed that smaller or stimulant doses are more beneficial than the larger ones suggested by Jones. The drug is undoubtedly less serviceable in delirium tremens characterized by high arterial tension.

Digitalis has been successfully employed in *acute mania* and *epilepsy*, Gowers recommending it in the latter disease as an adjuvant to the bromides, associated with belladonna. It is fair to state that in maniacal conditions the preponderance of testimony is

in favor of large doses—½ to 4 fluidrachms (1.8–15. Cc.) of the tincture.

Through its action in contracting the caliber of the arterioles digitalis serves as a valuable hemostatic in *hemoptysis*, *epistaxis*, *menorrhagia*, etc.

The drug is thought to enhance the influence of ergot in *post-partum hemorrhage*, and when associated with iron it is of value in *purpura hæmorrhagica*.

According to Harold Henry, digitalis and strychnine have proved beneficial in the *diarrhea complicating remittent fever*.

The drug, combined with ergot or potassium bromide according to the indications, has been successfully employed in *spermatorrhea* and *nocturnal emissions*.

It is said that absorption of *pleuritic effusion* is hastened by the continued administration of digitalis.

Clifford Allbutt recommends it in sufficient doses to reduce the pulse to 45 or 50 in *aneurysm*. This method of treatment, however, has not been widely adopted.

Digitalis is one of the best antidotes to *aconite-* and *muscarine-poisoning*.

The remedy is invaluable as a diuretic to relieve *cardiac* or *renal dropsy*, its efficiency being more apparent in the former variety, although acute renal dropsy usually yields to its influence. Should the renal structure be impaired, the drug is less serviceable, although, when combined with other appropriate remedies, it is decidedly beneficial in *chronic Bright's disease* with cardiac dilatation. In the early stages of the malady, accompanied by cardiac hypertrophy and high arterial tension, it is doubtful whether digitalis is indicated, either alone or in combination.

In conclusion, it should be stated that digitalis is recommended by all authors in every valvular disease of the heart, with the possible exception of aortic regurgitation, some writers supposing it to be harmful in this condition because of the prolonged diastole it occasions.

The author's experience leads him to differ with those who consider aortic insufficiency a contraindication to the use of this important drug. The excellent and logical reasons advanced by Professor Patton for the use of the remedy in aortic regurgitation coincide entirely with the author's views.

Contraindications.—Digitalis should not be given when there is marked degeneration of the heart-muscle or of the arterial walls. In simple hypertrophy, apoplexy, high arterial pressure,

or vascular excitement the use of the drug is inadvisable. Many physicians regard aneurysm as a contraindication to the use of digitalis.

Administration.—Any of the official preparations may be given, or the powdered leaves in pills or capsules—not at too frequent intervals, however, from four to eight hours elapsing between the doses, lest the drug accumulate in the system, producing poisonous symptoms.

When digitalis has been administered for some time to a patient suffering from ascites, and the fluid is removed by paracentesis, poisoning may ensue. It is well, therefore, to discontinue the remedy for two or three days before tapping the patient.

The rapidity of the drug's action upon the heart depends upon the presence or absence of a febrile state. The stimulant action upon the heart is usually observable in from twenty-four to thirty-six hours. The effects of the drug commonly continue from three to seven days after its discontinuance.

The powdered digitalis, though the most irritant to the stomach, fully represents the drug, which is true of none of the preparations.

Of the active constituents, digitalin is usually preferred, notwithstanding its uncertain action.

The infusion of digitalis, being an aqueous preparation and containing, therefore, a larger proportion of digitonin, is superior for diuretic purposes; while the alcoholic preparations, like the fluid extract and tincture, being richer in digitalin and digitalein, are preferable when an action upon the heart is desired.

Ordinarily, therefore, digitalis should be given in solution, the tincture and infusion being the most reliable preparations; care being taken in the selection of the crude drug upon the character of which the strength of the preparation depends.

In uncomplicated cases of cardiac failure, the result of valvular lesion, the tincture is most eligible. In cardiac failure associated with, or resulting from, kidney lesions the infusion, combined with some other diuretic, should be used.

Strophănthus—Strophănthi—Strophanthus.
U. S. P.

Origin.—The seed of *Strophanthus hispidus* D. C., deprived of its long awn. The plant is a woody climber, ascending to the tops of high trees, from which it hangs in festoons. It is found in

tropical Africa, where it is used to prepare an arrow-poison termed *kombi*.

Description and Properties.—The seeds are about $\frac{3}{4}$ inch (15 Mm.) long and $\frac{1}{8}$ to $\frac{1}{5}$ inch (4–5 Mm.) broad, oblong-lanceolate, flattened and obtusely-edged, grayish-green, covered with appressed silky hairs, one side extending into the attenuated, pointed end; kernel white and oily, consisting of a straight embryo having two cotyledons, and surrounded by a thin layer of perisperm; nearly inodorous; taste very bitter.

Strophanthus contains a glucosid, *strophanthin*, upon which its medicinal properties depend. It also contains kombic acid. Another active principle, *ouabaïn*, is obtained from a similar species of Strophanthus.

Official Preparations.

Tinctūra Strophănthi—Tinctūræ Strophănthi—Tincture of Strophanthus (5 per cent.).—*Dose*, 2–10 minims (0.12–0.6 Cc.).

Unofficial Preparations.

Strophănthin—Strophănthin—Strophanthin. *Origin.*—A glucosid obtained from the seeds of several species of Strophanthus, chiefly from *Strophanthus hispidus*.

Description and Properties.—A white, amorphous or crystalline powder, of an acidulous, intensely bitter taste; soluble in water and in alcohol.

Dose.—$\frac{1}{100}$ to $\frac{1}{60}$ grain (0.0006–0.001 Gm.).

Ouăbaïn—Ouăbaïn—Ouabaïn.—*Origin.*—A glucosid obtained from *Acocanthera ouabaïo* and *Strophanthus glabrus*.

Description and Properties.—A white, transparent, crystalline powder, inodorous and of a slightly bitter taste. Soluble in hot water, sparingly soluble in cold water, insoluble in alcohol.

Dose.—$\frac{1}{1000}$ to $\frac{1}{500}$ grain (0.000032–0.00012 Gm.).

Antagonists and Incompatibles.—Probably the same as for digitalis.

Synergists.—Digitalis, spartein, adonidin, etc.

Physiological Action.—*Externally and Locally.*—The tincture of strophanthus has no local action of importance. Strophanthin and ouabaïn, however, possess marked sedative properties, the latter being much the stronger. They paralyze the ends of the sensory nerves and are powerful local anesthetics, in this respect surpassing even cocaine in their influence upon the cornea, the anesthesia produced by the glucosids being of much longer duration than that caused by cocaine.

When poisonous amounts of ouabaïn are applied locally the motor nerves are paralyzed.

These substances apparently have no action upon the central nervous system.

Externally.—Digestive System.—Strophanthus is similar in its action to digitalis, though less apt to disturb digestion in small doses; on the contrary, its bitter taste tends to improve the appetite.

Ouabaïn increases peristalsis and acts as an emetic by centric influence.

Circulatory System.—Upon the heart its action is identical with that of digitalis, though differing from the latter drug in its effect upon arterial tension and the arterioles. Strophanthus does not contract the arterioles and the arterial pressure is but slightly raised, the elevation being due to the increased force of the heart, toxic doses paralyzing it in systole.

The glucosidal principle, ouabaïn, on the other hand, increases arterial tension and contracts the principal vessels in the same manner as digitalis.

Nervous System.—Strophanthus affects the nervous system even less than digitalis. Poisonous doses, while not influencing the motor nerves so much as digitalis, act as a direct muscle-poison.

Ouabaïn paralyzes both the sensory and motor nerves and abolishes reflex action, being a direct poison to the striated muscles.

Respiratory System.—It has no important action.

Ouabaïn primarily increases and secondarily diminishes respiration through its action upon the center.

Absorption and Elimination.—Strophanthus is rapidly absorbed, and more readily eliminated than digitalis, possessing no cumulative action. It is principally excreted by the kidneys, increasing the amount of urine by the strengthened heart's action. Unlike digitalis, the drug has no influence upon the caliber of the renal vessels.

Temperature.—Very large doses of strophanthus cause a slight reduction of temperature, not, however, to the extent of digitalis.

Eye.—Excessive doses contract the pupil and increase intraocular tension.

Uterus.—It resembles digitalis, though more feeble in its action upon the uterus.

The symptoms and treatment of *Poisoning* are similar to those described under Digitalis, although strophanthus is more apt to occasion diarrhea.

Therapeutics.—*Externally and Locally.*—STROPHANTHIN has been occasionally employed as a local anesthetic, but the testimony in its favor is hardly sufficient to encourage its use.

Internally.—STROPHANTHUS is a cardiac remedy, being indicated in the same varieties of heart disease as digitalis. It is of particular value in *stenosis of the mitral orifice*, having a happy influence in controlling the irregular rhythm, nervous dyspnea, and intermittent pains distinctive of this lesion. The drug is also well adapted in subduing functional irregularities of rhythm in cases of *irritable* or *tobacco heart.*

Theoretically, STROPHANTHUS is superior to digitalis in certain stages of *Bright's disease* and *heart failure* of elderly people with slightly degenerated arteries.

Shoemaker advocates the use of strophanthus in the treatment of *psoriasis*, combining it with the fluid extract of hoang-nan.

While in the majority of cardiac diseases digitalis should be first tried, where it fails strophanthus is the proper recourse. It is a peculiarly efficient drug in the *cardiac diseases of children*, according to the majority of observers being safer than digitalis for young patients.

STROPHANTHIN has been used hypodermically with some success for the relief of *chills* due to *malaria*, *shock*, or *nervousness.*

Dr. Gemmell and other observers claim that ouabaïn in doses of from $\frac{1}{1000}$ to $\frac{1}{500}$ grain (0.00006–0.00003 Gm.) greatly reduces the number and severity of the paroxysms in *whooping cough.*

Contraindications.—The same as for digitalis.

Administration.—Of the preparations of strophanthus, the tincture is preferable, both for convenience and safety. Should strophanthin or ouabaïn be desirable, a solution is to be preferred.

Scopārius—Scopārii—Scoparius. *U. S. P.*

(BROOM.)

Origin.—The tops of *Cytisus scoparius* L., a shrub 3 to 6 feet (.9–1.8 M.) high, found in Western Siberia and the greater part of Europe. It is sometimes cultivated, and is occasionally met with wild in some of the Middle and Southern States.

Description and Properties. — Occurring in thin, flexible, branched twigs, pentangular, winged, dark green, nearly smooth, tough, usually free from leaves; odor peculiar when bruised; taste disagreeably bitter.

The constituents of scoparius are an oily, bitter substance, *spar-*

teine, a cardiac stimulant, and a neutral, crystalline principle, *scoparin*, to which the diuretic action of the drug is due.

Dose.—½–1 drachm (2.0–4.0 Cc.), in infusion.

Official Preparations.

Extrăctum Scopārii Flūidum—Extrăcti Scopārii Flūidi—Fluid Extract of Scoparius.—*Dose*, ½–1 fluidrachm (2.0–4.0 Cc.).

Sparteīnæ Sūlphas—Sparteīnæ Sulphātis—Sparteine Sulphate.—The neutral sulphate obtained from the alkaloid sparteine.

Description and Properties.—Colorless, white, prismatic crystals, or a granular powder, odorless, and having a slightly saline and somewhat bitter taste; liable to attract moisture when exposed to damp air; very soluble in water and alcohol.

Dose.—$\frac{1}{20}$–2 grains (0.003–0.1 Gm.).

Unofficial Preparation.

Scopārine—Scopārine—Scoparine.—*Description and Properties.*—Amorphous or in small crystals, of a pale-yellow color, inodorous and tasteless.

Dose.—1–15 grains (0.06–1.0 Gm.), as a diuretic.

Antagonists and Incompatibles.—The antagonists are the same as for digitalis, and tannic acid and potassium iodide are incompatibles.

Synergists.—Digitalis, strophanthus, adonidin, etc.

Physiological Action.—*Externally and Locally.*—No action observed.

Internally.—Digestive System.—Sparteine sulphate acts like bitters in improving the appetite and digestion. Large doses, as with digitalis, produce vomiting and purging.

Circulatory System.—Cushing and Matthews claim that the action of sparteine upon the heart and blood-vessels is similar to that of digitalis; but numerous experiments upon animals show that the drug has no action upon these organs. Notwithstanding the results of the pharmacological experiments above referred to, the author has observed that, clinically, the drug is similar in its action to that of digitalis, save that it is not so powerful, but more rapid, though the arterioles are not contracted as is the case with digitalis.

Nervous System.—Sparteine resembles coniine rather than digitalis in its action upon the nervous system, depressing the brain and spinal cord, and lowering reflex action through paralysis of the motor nerve-endings. Under toxic doses there is also extreme muscular weakness, often complete paralysis.

Respiratory System.—Medicinal doses produce no effect. Toxic

doses slow and weaken the respiration, death being possible from paralysis of the respiratory center.

Absorption and Elimination.—It is rapidly absorbed and as readily eliminated, and, unlike digitalis, has no cumulative action. In disease it is an active diuretic, particularly the infusion or fluid extract or the alkaloid scoparin. Sparteine, on the other hand, is not an active diuretic.

Scoparius therefore increases the flow of urine and the excretion of urea, The drug has no direct action upon the renal structure, diuresis being produced by increased blood-pressure. It also possesses diaphoretic properties.

Poisoning.—The following symptoms occur: Small, rapid, and irregular pulse, dyspnea, great muscular weakness, incoördination of movement, and muscular tremors, followed possibly by clonic and tonic convulsions, which are replaced by marked depression of the nervous and muscular systems, and collapse, death usually resulting from paralysis of the respiratory center.

Treatment of Poisoning.—The respiration should be stimulated by hypodermic injections of strychnine and atropine. It may even be necessary to apply electricity over the vagi or practise artificial respiration. Potassium iodide or solutions of tannic acid should be given, and the free use of diuretics or diluents to favor elimination.

Therapeutics.—*Externally and Locally.*—No influence is exerted.

Internally.—SCOPARIUS is used for the same purposes as digitalis. It is particularly serviceable in some cases of *nephritis* with weak, irregular heart-action, and in *chronic Bright's disease* with cardiac hypertrophy and high arterial tension. It is also useful in the nervous, irregular heart of opium habitués.

SPARTEINE SULPHATE has been recommended in *paralysis agitans* and *asthma*. Like strophanthus, it is of more value in mitral than in other valvular diseases.

For some reason scoparius is generally less esteemed than digitalis, although, while competent clinicians consider it of minor importance as a cardiac remedy, the drug is not without enthusiastic advocates among those of authority.

Contraindications.—Practically the same as for digitalis, though less definite.

Administration.—The fluid extract of scoparius may be given, or the decoction, "made by adding ½ an ounce (16.0 Gm.) of the broom-tops to 1 pint (½ liter) of water and boiling them down to

½ pint (250 Cc.). Of this 1 ounce (32.0 Cc.) should be taken every three hours. This decoction is one of the most efficient diuretics in cardiac dropsy" (Hare).

The sparteine sulphate is usually employed when an action on the heart is desired: it may be administered either hypodermically, in pill, capsule, or aqueous solution.

Căctus—Căcti—Cactus.

(NIGHT-BLOOMING CEREUS.)

Origin.—The stems and flowers of *Cactus grandiflorus* L., a plant indigenous in tropical America and frequently cultivated for ornament.

Preparations.

Extrăctum Căcti Flūidum—Extrăcti Căcti Flūidi—Fluid Extract of Cactus.—*Dose*, 5–10 minims (0.3–0.6 Cc.).

Tinctūra Căcti—Tinctūræ Căcti—Tincture of Cactus.—*Dose*, 15–20 minims (1.–1.2 Cc.).

Physiological Action and Therapeutics.—Cactus differs from digitalis in its less disturbing influence upon the digestive apparatus.

Its action upon the circulation is to elevate arterial pressure and increase the strength and rapidity of the heart's action when given in medicinal doses. Toxic doses, on the contrary, diminish both the blood-pressure and the pulse-rate, rendering the heart irregular in its action and arresting it in systole. Moreover, the reflexes are increased by poisonous doses, death being preceded by clonic and tetanic convulsions of spinal origin.

Therapeutically, cactus probably possesses no advantages over digitalis. It has, however, been highly recommended by certain physicians in *myocarditis, aortic regurgitation, functional disorders of the heart, severe arrhythmia, angina pectoris*, and *cardiac weakness* following typhoid fever.

Dr. Wilcox considers mitral stenosis a contraindication to its use. It is asserted that it produces no cumulative effects or untoward symptoms.

Adōnis Vernālis—Adōnidis Vernālis—False Hellebore.

(PHEASANT'S EYE.)

A perennial herb attaining a height of about 10 inches, indigenous in Europe.

Description and Properties.—It has but little odor and a somewhat acrid and bitter taste. The plant contains a glucosid, *adonidin*, to which it owes its medicinal properties. This constituent is a light-colored, crystalline powder, of a bitter taste and soluble in water and alcohol.

Dose of Adonidin.—$\frac{1}{20}$–$\frac{1}{4}$ grain (0.003–0.01 Gm.).

Antagonists, Incompatibles, and Synergists.—The same as for digitalis.

Physiological Action and Therapeutics.—The action of adonidin is similar to that of digitalis, although more nearly resembling that of digitalin, save that it is not cumulative.

It is used for the same purposes as digitalis, being peculiarly valuable in relieving the pains of heart disease, and is by some physicians preferred to digitalis in the treatment of *aortic* and *mitral insufficiency*, *cardiac asthma*, and *functional irregularity of the heart.*

Convallāria—Convallāriæ—Convallaria. *U. S. P.*

(LILY OF THE VALLEY.)

Origin.—The rhizome and roots of *Convallaria majalis* L., a stemless perennial indigenous in Europe, Northern Asia, and North America.

Description and Properties.—Of horizontal growth and somewhat branched, about $\frac{1}{8}$ inch (3 Mm.) thick, cylindrical, wrinkled, whitish, marked with a few circular scars; at the annulate joint with about eight or ten thin roots; fracture somewhat fibrous, white; odor peculiar, pleasant; taste sweetish, bitter, and somewhat acrid.

Convallaria contains two glucosids: *convallamarin*, the cardiac-acting principle; and *convallarin*, an emeto-cathartic principle.

Official Preparations.

Extractum Convallariæ Fluidum—Extracti Convallariæ Fluidi—Fluid Extract of Convallaria.—*Dose*, 15–30 minims (1–2 Cc.).

Unofficial Preparations.

Extractum Convallariæ—Extracti Convallariæ—Extract of Convallaria.—*Dose*, 5–15 grains (0.3–1.0 Cc.).

Infusum Convallariæ—Infusi Convallariæ—Infusion of Convallaria.—*Dose*, ½–2 ounces (15–60 Cc.) (25 parts in 75 parts of water).

Convallamarinum — Convallamarini — Convallamarin. — *Description and Properties.*—A whitish-brown, amorphous powder, soluble in water and alcohol.

Dose.—$\frac{1}{4}$–2 grains (0.016–0.12 Gm.).

Convallarinum—Convallarini—Convallarin.—*Description and Properties.*—A crystalline body insoluble in water, soluble in alcohol.

Dose.—2–4 grains (0.12–0.24 Gm.).

Antagonists and Incompatibles.—The antagonists are the same as for digitalis; tannic acid precipitates the convallamarin.

Synergists.—The cardiac stimulants enhance its cardiac action; emetics and cathartics aid its emeto-cathartic effects.

Physiological Action.—Almost identical with that of digitalis, but less powerful and possessing no cumulative action. Preparations free from convallarin do not disturb the stomach nor affect the cerebro-spinal functions. It is asserted that convallaria has stronger diuretic properties than digitalis.

Convallamarin in some cases has produced, among other untoward symptoms, hemoptysis and dyspnea.

Convallarin is a drastic purgative, and in full doses occasions nausea and gastric pain.

Therapeutics.—CONVALLARIA is used for the same purposes exactly as digitalis. The only advantage it possesses over the latter drug is that it has no cumulative action. By some physicians it is considered superior to digitalis as a diuretic and cardiac stimulant after failure of compensation, the diuresis it occasions persisting for some time after the withdrawal of the drug.

It has been employed with some benefit in various forms of *neuralgia*, and has even been recommended to calm the *restlessness* and relieve the *insomnia of fever*.

Contraindications.—The same as for digitalis.

Administration.—The fluid extract is the best preparation to use, although the infusion is highly recommended by many physicians.

Caffēina—Caffēinæ—Caffeine. *U. S. P.*

Origin.—A feebly basic, proximate principle obtained from the dried leaves of *Thea Sinensis* (tea) L., or from the dried seeds of *Coffea Arabica* (coffee) L., and found also in other plants.

It may also be prepared synthetically from theobromine by the introduction of a third methyl group.

Description and Properties.—Fleecy masses of long, flexible, white crystals, having a silky luster, without odor and of a bitter taste; permanent in the air; soluble in 80 parts of water and 33 parts of alcohol.

Dose.—2–5 grains (0.12–0.3 Gm.).

Official Preparations.

Caffēina Citrāta — Caffēinæ Citrātæ — Caffeine Citrate.—*Description and Properties.*—A white powder, odorless, having a purely acid taste and an acid

reaction. 1 part of citrated caffeine forms a clear, syrupy solution with about 3 parts of water.

Dose.—2–5 grains (0.12–0.3 Gm.).

Caffēina Citrāta Effervĕscens—Caffēinæ Citrātæ Effervescĕntis—Effervescent Citrated Caffeine.—*Dose*, 1–4 drachms (4.0–16.0 Gm.).

Allied Compounds.

Guăranine.—The alkaloid obtained from the seeds of *Paullinia cupana.*

Thēine.—An alkaloid obtained from tea.

Theobrōmine.—An alkaloid obtained from cacao seeds.

Sōdio-theobrōmine Salĭcylate (Diuretin).—An active diuretic described under the group "Diuretics."

Guaranine, theine, and theobromine, while chemically almost identical with caffeine, differ from it somewhat in their physiological action.

Guaranine depresses first the sensory and afterward the motor nerves, affecting them from the center toward the periphery. Its primary effect in toxic doses is to produce general hyperesthesia, succeeded by convulsions of spinal origin.

Theine in its action very closely resembles guaranine, save that when injected it causes local anesthesia. It lowers the temperature, while caffeine tends to raise bodily heat.

Theobromine differs in no essential from caffeine.

Antagonists and Incompatibles.—Cerebral and cardiac depressants antagonize the action of caffeine.

Synergists.—Members of this group and the Cerebral and Motor Excitants. The action of caffeine upon the digestive tract may be enhanced by the vegetable bitters.

Physiological Action.—*Externally and Locally.*—Caffeine possesses no very important local action, though freshly roasted coffee is slightly analgesic and deodorant—a property due to the empyreumatic oils developed by roasting rather than to the caffeine which it contains.

Internally.—Digestive System.—In moderate amounts caffeine, like tea and coffee, stimulates the appetite, improving the digestion, and relieving the sense of plenitude in the stomach. All of them increase peristalsis and (particularly coffee) act as mild laxatives and slightly stimulate the secretion of bile.

Immoderate and continued dosage of caffeine or the excessive use of tea and coffee profoundly disturbs the digestive function, resulting in gastric catarrh, indigestion, hepatic congestion, constipation, and hemorrhoids.

Circulatory System.—Medicinal doses of caffeine strengthen and quicken the heart's action. The rapidity of the heart's action is increased, shortening the diastolic period, the drug in this respect differing from digitalis; at the same time the arterial pressure is elevated.

The precise *modus operandi* of caffeine in its action upon the circulatory system is still a disputed question, some investigators claiming that its whole and only influence proceeds from a direct stimulation of the heart-muscle, while others consider its action to be upon the nervous system. So far as relates to arterial pressure, the preponderance of testimony seems to prove that the tension is raised independently of any action on the vaso-motor centers. Excessive doses depress the heart, causing an irregular, slow, and weak pulse.

Nervous System.—The drug is a decided cerebral excitant, stimulating the mental function, occasioning wakefulness, and under large doses producing hallucinations and delirium.

There is a marked difference between the effects upon the brain caused by caffeine and those occasioned by opium. The former renders the reasoning and imaginative powers more acute, enabling the person to perform increased and prolonged mental work. Moreover, the cerebral excitation caused by caffeine is not succeeded by mental depression and sleep; while opium occasions an incoördination of mental activity, the brain being incapable of performing active practical and physiological work, and the reasoning powers rendered subservient to the imaginative. The opium habitué thus becomes a visionary, his mental powers inclining more to revery than to action. The primary excitation induced by the drug, however, is soon succeeded by lethargy and sleep.

The moderate use of tea or coffee increases muscular endurance; large doses, on the other hand, occasion muscular trembling and marked weakness. Excessive doses lessen the activity of the spinal reflex centers. In moderate amounts coffee possesses some aphrodisiac action.

Respiratory System.—Medicinal doses slightly stimulate, while toxic doses depress, the respiration.

Absorption and Elimination.—Caffeine is freely absorbed, and is chiefly eliminated by the kidneys, a portion being oxidized in the body. The primary effect of the drug upon the kidneys is to diminish the blood-supply to the kidneys, thereby lessening the amount of urine. At the same time the drug has a direct stimulating action upon the secreting structure of the kidney, and if its effect upon the vaso-motor center is not too marked its general action is that of a diuretic.

Ordinarily, caffeine lessens tissue-waste; the elimination of urea,

however, is not uniform, being in some cases increased and in others diminished.

Temperature.—Under large doses of the drug the temperature is slightly elevated, the result of combined increase of heat-production and heat-dissipation. Toxic doses first raise and then depress temperature.

Eye.—Strong solutions of caffeine applied to the cornea act as a mild mydriatic and anesthetic. Hutchinson records a case of amblyopia produced by the drug.

Untoward Action.—Caffeine occasionally causes marked cerebral congestion, insomnia, and embarrassment of respiration, while the untoward effects of an immoderate use of coffee are described by Guilliot (*Nat. Disp.*, p. 363) as follows:

"The skin is pale or dusky, the expression is dull, and the features have the look of premature old age, and sometimes are slightly swollen. The flesh wastes, the eyes have a glassy look, the pupils are dilated, the lips and tongue are tremulous; the appetite is lost; there is insomnia or else disturbed sleep; dyspepsia accompanies constipation or diarrhea; neuralgia affects the stomach and other parts; headache and vertigo are common, and spasms or general convulsions may occur." According to the same writer, "habitual excess of coffee induces in men sexual apathy and impotence, and in women leucorrhea. Sometimes it produces *pruritus ani aut vulvæ*."

Poisoning.—A case has been reported by Liell where 18 grains (1.16 Gm.) of citrated caffeine taken by a woman were in an hour and a half accompanied by the following symptoms:

"Delirium, semi-consciousness, absence of headache, pulse 55 and irregular, cold extremities and general clammy perspiration, normal temperature (?), anesthesia, slight paresis of hands, feet, and tongue, and a reeling gait. Convulsions followed of a tetanoid character; the pupils were normal, the vision dim; some vomiting took place; there was abdominal colic, but no opening of the bowels; and urination was frequent and copious."

Treatment of Poisoning.—This should include the use of emetics and eliminants, together with diffusible stimulants and the application of external heat.

Therapeutics.—*Externally and Locally.*—Burning COFFEE in a room deodorizes the air. Powdered coffee is used to disguise the offensive odor of iodoform, and is frequently associated with it in

the form of an ointment in the treatment of *aural eczema*. Equal portions of pulverized coffee and boric acid have been recommended by Guerder as an insufflation in *whooping-cough*.

Internally.—The chief value of CAFFEINE is as a diuretic and cardiac stimulant, being peculiarly useful in cases of *senile cardiopathies associated with nephritis*, in which, from degeneration of the heart-muscle, digitalis is not well tolerated.

In some instances the primary effect of caffeine is to increase the pulse-rate; usually, however, if the remedy be adapted to the case, there is a secondary slowing of the heart's action. The drug is considered by some physicians to be superior to digitalis as a cardiac stimulant in valvular disease accompanied by *fatty heart*. It is an efficient remedy to counteract the *cardiac depression in low fevers*, and is a comparatively safe drug in *myocarditis*.

It is a remarkably efficacious remedy in *cardiac* and *renal dropsy* and to remove *pleuritic effusion*, etc.

Its action upon the digestive system renders caffeine of great value as a stomachic tonic. *Migraine*, due either to gastric catarrh or nervousness, frequently yields to this drug.

Its value in the treatment of *headaches* may be enhanced by administering it together with antipyrine or sodium bromide.

Choleraic diarrhea, the result of nervous depression, is often markedly benefited by CITRATED CAFFEINE. It has also been used with some success in the *diarrhea of phthisis*.

The pains of *locomotor ataxia* have been greatly relieved by the hypodermic injection of from $\frac{1}{6}$ to $\frac{1}{2}$ grain (0.01–0.03 Gm.) of THEINE.

SODIO-BENZOATE OF CAFFEINE in doses of 5 to 10 grains (0.32–0.64 Gm.) is considered by Misrachi to be superior to ergot in *post-partum hemorrhage*. CAFFEINE possesses a considerable reputation as a remedy for *asthma*.

It is a matter of frequent observation that strong COFFEE certainly modifies the effects of *alcoholic intoxication*. *Hiccough* is often relieved by coffee.

CAFFEINE or strong COFFEE has unquestionably proved valuable in the reduction of *strangulated hernias* after taxis has failed.

The medical uses of CAFFEINE would be incomplete without mention of its extreme value in *opium-poisoning*. Here a salt of c :d hypodermically or a strong infusion of COFFEE · rectum.

In conclusion, it may not be out of place, in comparing this drug with digitalis, to quote again from the *National Dispensatory*, 5th ed., p. 365: "Unlike digitalis, which affects only certain involuntary muscles, caffeine, like alcohol, stimulates the entire muscular and vascular systems. It has been repeatedly said that caffeine and digitalis cannot be therapeutically substituted for one another —that the former acts where the latter ceases to act; and the explanation of this fact resides in their very dissimilar modes of action. When digitalis fails, it is because the heart is either positively or relatively incompetent to propel the blood, and the medicine has no power of strengthening except by tonically contracting it; but coffee or caffeine stimulates the nervous centers which are the source of the heart's power, and temporarily restores the regularity and efficiency of its function, and so permits the removal of the dropsies, etc. which immediately threaten the extinction of life."

Contraindications.—Ordinarily, caffeine is contraindicated in acute inflammations, particularly of the kidneys.

Administration.—The alkaloid may be given by the stomach, but when hypodermic medication is desired caffeine is unavailable, a fresh salt for hypodermic use being properly employed, made by combining caffeine with salicylic acid, cinnamic acid, or sodium benzoate. The latter salt—sodio-benzoate of caffeine—is probably the most eligible and contains 45 per cent. of caffeine.

The citrated caffeine should be given in pills, capsules, or tablets; the effervescent citrate, in water.

A valerianate of caffeine is prepared which has been employed with success, it is asserted, in *hysterical vomiting* and *whooping cough* in doses of from ½ to 2 grains (0.03–0.12 Gm.).

Strong coffee serves as a most excellent substitute for the alkaloid, and may be given by the mouth or as an enema.

Ălcohol—Ălcohōlis—Alcohol. *U. S. P.*

Origin.—A liquid composed of about 91 per cent. by weight or 94 per cent. by volume of Ethyl Alcohol, and about 9 per cent. by weight of Water.

Description and Properties.—A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Miscible with water, ether, or chloroform in all proportions. It is inflammable, and readily volatilized even at low temperatures. Alcohol should be kept in well-closed vessels, in a cool place, remote from lights or fire.

Official Preparation.

Ălcohol Dilūtum—Alcohōlis Dilūti—Diluted Alcohol.—A liquid composed of about 41 per cent. by weight, or about 48.6 per cent. by volume, of absolute Ethyl Alcohol, and about 59 per cent. by weight of Water. It should be kept in well-closed vessels, in a cool place, remote from lights or fire.

Ălcohol Absolutūm—Alcohōlis Absolūti—Absolute Alcohol. *U. S. P.*

Origin.—Ethyl Alcohol, containing not more than 1 per cent. by weight of Water.

Description and Properties.—A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Very hygroscopic. It should be kept in well-stoppered bottles or tin cans, in a cool place, remote from lights or fire.

Ălcohol Deodorātum—Alcohōlis Deodorāti—Deodorized Alcohol. *U. S. P.*

Origin.—A liquid composed of about 92.5 per cent. by weight, or 95.1 per cent. by volume, of Ethyl Alcohol, and about 7.5 per cent. by weight of Water.

Description and Properties.—As given and described under Absolute Alcohol.

Spīritus Vīni Găllici—Spīritus Vīni Găllici—Brandy. *U. S. P.*

Origin.—An alcoholic liquid obtained by the distillation of the fermented, unmodified juice of fresh grapes, and at least four years old.

Description and Properties.—A pale amber-colored liquid, having a distinctive odor and taste and a slightly acid reaction. Its specific gravity should not be more than 0.941, nor less than 0.925, corresponding, approximately, to an alcoholic strength of 39 to 47 per cent. by weight or 46 to 55 per cent. by volume.

Spīritus Frumĕnti—Spīritus Frumĕnti—Whiskey. *U. S. P.*

Origin.—An alcoholic liquid obtained by the distillation of the ash of fermented grain—usually mixtures of Corn, Wheat, and —and at least two years old.

Description and Properties.—An amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction. Its specific gravity should not be more than 0.930 nor less than 0.917, corresponding, approximately, to an alcoholic strength of 44 to 50 per cent. by weight or 50 to 58 per cent. by volume.

Vīnum Ălbum—Vīni Ălbi—White Wine. *U. S. P.*

Origin.—An alcoholic liquid made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* (nat. ord. *Vitaceæ*), freed from seeds, stems, and skins.

Description and Properties.—A pale amber-colored or straw-colored liquid, having a pleasant odor, free from yeastiness, and a fruity, agreeable, slightly spirituous taste, without excessive sweetness or acidity. It should contain not less than 10 nor more than 14 per cent. by weight—equivalent to 12.4 to 17.3 per cent. by volume—of absolute alcohol.

Vīnum Rūbrum—Vīni Rūbri—Red Wine. *U. S. P.*

Origin.—An alcoholic liquid made by fermenting the juice of fresh, colored grapes, together with their skins.

Description and Properties.—A deep red liquid, having a pleasant odor, free from yeastiness, and a fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive sweetness or acidity. It should contain not less than 10 nor more than 14 per cent. by weight—equivalent to 12.4 to 17.3 per cent. by volume—of absolute alcohol.

Unofficial Alcoholic Preparations.

Spīritus Rectificātus—Spīritus Rectificāti—Rectified Spirit contains 85 per cent. by weight of absolute alcohol.

Proof Spirit contains 49 per cent. by weight of absolute alcohol, together with a peculiar volatile oil and other foreign material.

Gin is usually distilled in Holland from rye or barley, and flavored with juniper berries and hops. It contains about 42 per cent. by weight of absolute alcohol, and is probably more diuretic than other liquors because of the oil of juniper it contains.

Rum is obtained by distilling fermented molasses, having about the same alcoholic strength as gin.

Port Wine is prepared by adding spirit during the process of manufacture, bringing the alcoholic strength up to 30 or 40 per cent.

Sherry Wine is a dry wine, having from 20 to 35 per cent. of alcohol.

Sparkling Wines contain from 8 to 10 per cent. of alcohol. They are more or less sweet wines, and are charged with carbonic acid, being bottled before fermentation is completed, the grape-sugar, in consequence, not undergoing conversion into alcohol, The sparkling wines are Champagne, Hock, and Sparkling Catawba.

Sweet Wines are those in which the sugar has not all been converted into alcohol, the alcoholic strength being therefore relatively low—from 6 to 7 per cent. Among the sweet wines may be classed Angelica, Madeira, Malaga, Muscatel, Tokay, etc.

Dry Acid Wines are those in which the fermentation is complete, the alcoholic strength varying from 5 to 7 per cent. They are such as California Hock, Ohio and Kelly Island Catawba, Rhine and Moselle wines, Hochheimer, Dürkheimer, Deidesheimer, etc.

Light Red Wines contain 5 to 7 per cent. of alcohol, and are astringent, containing tannic acid and the coloring matter of the grape. They are Claret, Red Rhine, Concord, Hungarian, etc.

Beer, Ale, and **Porter** are prepared by fermenting malted grain with hops and adding other bitters. Beer contains from 2 to 3 per cent. of alcohol; ale and porter, from 4 to 6 per cent., besides carbonic and lactic acids, malt extract, various aromatics, and potassium and sodium salts.

Antagonists and Incompatibles.—The motor, cerebral, and cardiac depressants are antagonistic to moderate amounts of alcohol.

Synergists.—The motor excitants, atropine, ether, and the diffusible stimulants.

Physiological Action.—Few drugs have occasioned such diversity of opinion regarding their physiological action and uses as alcohol. With those who—as Nathaniel asked, "Can any good thing come out of Nazareth?"—question whether any benefit can accrue from alcohol, being honestly convinced that the drug possesses no value in medicine, the author begs leave to take respectful yet decided issue. Indeed, extensive reading, experimentation, and clinical experience have alike proved to him conclusively that we have in alcohol a drug endued with peculiar and invaluable properties, rendering its efficacy inferior to that of no remedy in the range of materia medica. Like opium and other powerful agents, the drug may prove noxious or beneficial according to the manner and judgment with which it is employed.

The physiological action as here given agrees with the best authorities on the subject.

Externally and Locally.—Alcohol is a powerful antiseptic and disinfectant. It possesses also rubefacient, astringent, and anhidrotic properties. When applied in full strength to the skin it produces a sensation of coldness, due to rapid evaporation. Should the drug be diluted, the sensation of cold is greatly diminished. If evaporation be prevented, the effect is that of heat or burning, owing to the penetration of the drug through the epidermis and its chemical influence upon the tissues beneath.

Its effect upon mucous membranes is similar to that upon the

skin, save that the former are more readily affected. The mucous membrane becomes whitened and corrugated, because of the coagulation of albumin and the abstraction of water. The white film, which is the precipitated albumin, later disappears as the albumin is redissolved in liquids present, although the prolonged action of alcohol upon mucous membranes produces a permanent coagulation.

When the drug is applied to the skin the secretion of sweat is lessened and the cutaneous blood-vessels contracted.

Internally.—Digestive System.—The local action upon the mucous membrane of the mouth is as above described. There is a burning sensation, and marked increase of saliva due entirely to reflex action. When ingested a sense of warmth is experienced in the stomach, the blood-vessels of which are dilated, with accompanying increase in the secretion of gastric juice, as well as stimulation of peristaltic action. As a consequence, moderate amounts of the drug, when taken before meals, improve the appetite and favor digestion; if taken during the active period of digestion, the process is retarded.

It will be observed that the action of alcohol upon the digestive system is quite similar to that of vegetable bitters, immoderate amounts checking the flow of gastric juice and increasing the secretion of mucus, producing a catarrhal condition; while excessive doses or the daily and intemperate use of the drug frequently occasions nausea and vomiting.

Upon the intestines alcohol acts as an astringent, brandy being an efficient agent in checking diarrhea. Small amounts of the drug act as an hepatic stimulant, while large quantities change the character of the bile, at the same time lessening its amount.

Circulatory System.—Taken into the stomach, alcohol reflexly and rapidly stimulates the heart before absorption can take place, the effect upon the circulation persisting after the drug is absorbed. Cardiac action is rendered more rapid and forcible, probably by stimulation of the heart-muscle, as well as of the accelerator center in the medulla. Arterial tension is raised, although the blood-vessels are dilated, especially those of the skin, owing to the depression of the vaso-motor center located in the vessel-walls. Toxic doses depress the heart and still further dilate the arterioles, greatly lowering the blood-pressure. This action of alcohol, in causing the heart to beat stronger and faster, at the same time dilating the blood-vessels—particularly those of

the peripheries—renders the drug one of the most valuable diffusible stimulants.

Excessive doses of alcohol greatly depress or paralyze the heart, while an enormous amount, when taken upon an empty stomach, by reflex action occasioning cardiac paralysis, may produce instantaneous collapse.

The ameboid movements of the white blood-corpuscles are temporarily increased, though subsequently diminished. The function of the red corpuscles is impaired, preventing the oxyhemoglobin from parting with its oxygen, consequently retarding oxidation in the tissues. It is a matter of observation that persons addicted to the habitual use of alcohol are frequently obese, on account of the imperfect combustion of fat and its consequent accumulation in the tissues.

Experiments have conclusively shown that moderate amounts of alcohol are oxidized during their circulation in the body. Alcohol must, then, serve as a food to a certain extent. Indeed, experiments have irrefutably proved that the body-weight of an animal may be maintained for a considerable period upon alcohol alone. This peculiar and apparently paradoxical property, of lessening and at the same time undergoing oxidation, renders the drug of eminent value in certain conditions.

Nervous System.—Moderate amounts of alcohol stimulate the nervous system, particularly the brain, chiefly through the increased supply of blood to the parts, although the drug probably exerts some influence also upon the nerve-cells. The highest nerve-centers are first affected, so that a person who has taken alcohol displays a keener intelligence, a brighter wit, and possesses a sense of general mental and physical power. Should the dose have been large, depression is wont to succeed the feeling of exaltation, the functions in general sharing in the change, which passes from the highest to the lowest centers in regular succession, the order of functional disturbance being that of the cerebrum, cerebellum, spinal cord, and, lastly, the medulla oblongata.

It will be observed that in this descending scale of functional derangement the mental faculties, being the highest, are earliest affected, resulting in failure of coördination in reasoning power and loss of control in the logical sequence of ideas, although the imagination, the emotions, and the faculty of speech may still retain their normal energy and exercise. Soon, however, the will-power succumbs; the emotions, while yet stimulated, are no longer

subject to mental command; the imagination becomes disordered; and the patient laughs and weeps hysterically, and, as a final result accompanying this stage of intoxication, the power of speech is merged in spasmodic, incoherent, or almost inaudible utterances or perhaps total dumbness.

The muscular system, being less highly organized, may still retain its activity; yet it at last yields to the influence of the poison, the movements becoming wholly incoördinate, until the patient sinks into a condition of drowsy, helpless stupor, in which he is incapable of the slightest effort dependent upon muscular energy.

Consequent to this stage is the influence upon the spinal cord, the reflex centers in which are abolished, the patient micturating and defecating involuntarily. Meanwhile the respiratory center, hitherto unaffected, shares the general influence of the drug. The breathing is difficult, or even paralyzed, and the face livid. At length the cardiac movements are involved, and, the paralysis affecting its functions—at first stimulated—fatal collapse ensues.

A frequent phenomenon incident to the depression of the reflex centers is found in the fact that injuries which under normal conditions might prove fatal to the subject have little or no effect upon the system saturated with alcohol, the heart and respiratory apparatus being for the time immune against reflex action.

Respiratory System.—Medicinal amounts deepen and accelerate respiration; large doses render the breathing slow and shallow,—these effects being due to stimulation or depression of the respiratory center. Death from a toxic dose of alcohol usually results from paralysis of respiration. It may be noted that under toxic dosage of the drug the amount of carbonic acid exhaled is diminished.

Absorption and Elimination.—Alcohol is very rapidly absorbed, and "eliminated unchanged in small proportion to the quantity ingested," owing to the fact that the greater proportion of it is oxidized in the body. The kidneys, lungs, skin, and liver share in the excretory process.

The quantity of urine is greatly increased, principally on account of increased arterial pressure, although the amount of urea, sodium chloride, and uric, phosphoric, and sulphuric acids in the urine is diminished by alcohol.

When taken internally the amount of sweat is slightly increased, due partly to a direct stimulation of the sweat-glands, and partly to the dilatation of the cutaneous blood-vessels.

Temperature.—Alcohol is an antipyretic of considerable power. This action is owing (1) to lessening of tissue-oxidation; (2) to the cooling of the blood through dilatation of the cutaneous blood-vessels, subjecting the warm blood from the interior of the body to the cooling influence of the atmosphere; (3) to the cooling of the surface of the body from the evaporation of sweat. The power to resist cold is diminished by the habitual use of alcohol. The drug would be useful in stimulating warmth in a person who had been long exposed to cold, but only in a warm room. Then, by rapidly dilating the blood-vessels of the skin and allowing the blood to flow to the surface, the subject is favorably affected by the external heat, while there is less danger of congestion in some internal organ.

Eye.—The excessive use of alcohol may produce amblyopia, watery eyes, and congested conjunctivæ.

Untoward Action is fully described under "Poisoning."

Poisoning.—The untoward or poisonous action of alcohol may be divided into what are known as *Acute* and *Chronic Alcoholism.* The former has been described in detail under the effect of alcohol upon the Nervous System, and doubtless most readers are too familiar, from observation, with the effects of alcoholic intoxication to require further enlightenment as to its general phenomena.

A serious and altogether too frequent accompaniment of acute alcoholism is *delirium tremens*, the symptoms of which are as follows: The malady is usually announced by marked anorexia, insomnia, and restlessness; tremor, especially of the tongue; disorders of vision and hearing; great mental depression; a soft and weak pulse; and cold extremities. These manifestations are succeeded in a day or two by active delirium, even passing into wild mania and horrible hallucinations, in which the distorted imagination conjures up the most loathsome images of reptiles, the vivid spectacle of which preys upon the mind with pitiable terror and dismay. Even the tenderest offices in behalf of the sufferer are perverted by the disordered reason, which becomes possessed only with the sentiment of abject, agonizing fear.

The muscles are in a constant tremor, and the patient talks incessantly and incoherently. The pulse is usually rapid, feeble, and dicrotic, and insomnia is continuous. The patient may even pass into a state of coma-vigil, which is generally the precursor of death, or fatal collapse may occur suddenly and unexpectedly. In other

cases the sufferer may relapse into a sound sleep, when the delirium subsides and convalescence is established.

It should be observed that *alcoholic coma* may be confounded with uremic coma, apoplexy, opium-narcosis, sunstroke, epileptic coma, or asphyxia.

Diabetic or hysterical coma may also be confounded with alcoholic coma. So far as the odor of the breath is concerned, it is not pathognomonic, since a person in a comatose condition from other causes may have previously taken sufficient alcohol to impart to the breath a distinct odor of the drug.

It is often, in fact, extremely difficult to make a positive diagnosis of true alcoholic coma. It may sometimes happen that the patient is suffering from the combined action of alcohol and opium or noxious gases, or that he has been seized with cerebral hemorrhage or sunstroke.

Chronic alcoholism is generally the result of the continuous and excessive use of alcohol. The symptoms vary according to the individual case. There may be (1) the moderate, daily drinker; (2) the periodical inebriate, usually the highly gifted, sensitive, and sympathetic, who drinks to excess at certain distinct intervals with a deliberation and moral perversity expressed by the declaration of a noted British general: "By the blessing of God, I intend to get gloriously drunk next Saturday night;" (3) the immoderate, impulsive, maniacal inebriate, who, during his usually brief existence after the establishment of the disease, is subject to constant and excessive indulgence, incapacitating him from the simplest duties of a rational life.

The habitual drinker sooner or later suffers from disturbed digestion, gastric catarrh, and irregularity of the bowels; his face is usually puffed and bloated, while the capillaries, especially of the cheeks and nose, become permanently dilated, marked acne rosacea not infrequently developing in the latter organ.

The excessive use of alcohol predisposes the subject to cirrhosis of the liver, other conditions being arterio-sclerosis, fatty degeneration of the heart and liver, paralysis, peripheral neuritis, Bright's disease, amaurosis, ataxia, epilepsy, insanity, etc.

Treatment of Acute Alcoholic Poisoning.—The stomach should be emptied of all unabsorbed alcohol; cautious inhalations of ammonia should be given, accompanied by the internal administration of the aromatic spirit of ammonia and black coffee. Capsicum and vinegar also have the power to stimulate the patient and counteract

the ill effects of alcohol, while it is said that ammonium chloride, in a dose of 30 grains (2.0 Gm.) given in 8 ounces (236.59 Cc.) of water, is an exceedingly efficient antagonist.

Should there be great depression of respiration, faradism of the muscles of respiration may be necessary, with warm applications to the extremities and cold to the head. Hot milk and other forms of nutritious liquid food form an essential element in the restoration of the patient.

Treatment of Delirium Tremens.—The management of this phase of alcoholism requires great skill and judgment, the student being referred for details to any standard work on the Practice of Medicine. The indications are to quiet the patient and sustain his physical strength. This has been accomplished by the administration of chloral and potassium bromide or opium, these drugs, together with digitalis, strychnine, and other cardiac stimulants, having proved highly efficient remedies. Gastric sedatives may be required, such as bismuth, carbolic acid, hydrocyanic acid, etc.

Nutritious and easily digested food should be given, and, in case of gastric intolerance, enemata should be adopted.

Treatment of Chronic Alcoholism.—A thoughtful and extended experience with inebriates has convinced the author that the great majority of dipsomaniacs suffer from a disease possessing usually a distinct and traceable etiology and resulting from either inherited or acquired neurosis. In many cases the malady is characterized by uniform development, progress, symptomatology, and termination.

The author makes this statement with the full knowledge that he will be regarded as a "sentimentalist" by many professedly "practical" men. Yet a careful scrutiny of numerous cases and a consideration of the means adopted in the treatment of them will, he believes, convince the thoughtful physician that he has to deal with a thoroughly diseased organism rather than with the victim of a "vicious drug habit" readily overcome by a moderate exercise of the will.

The medicinal agents most serviceable in the treatment of chronic alcoholism are strychnine, atropine, small doses of the alteratives, arsenic, potassium iodide, and mercury, while phosphorus and other restoratives and tonics will frequently be found useful.

The hygienic surroundings should be of the best, and the treatment should include a nutritious, non-stimulating diet taken with

regularity, and the free use of fruits and vegetables. Close attention should be paid to the condition of the bowels and skin, and, among other remedial influences, should be mentioned laxatives when necessary, frequent Turkish baths, and, above all, change of scene and engaging mental occupation.

From time to time various drugs have been heralded as specifics in the treatment of alcoholism, certain "cures" (*sic*) acquiring an influence among the ignorant and unscientific wholly at variance with the therapeutic value of these vaunted remedies. It is superfluous to say that to a skilled and enlightened professional judgment the rationale of intemperance and the agents serving to mitigate the malady present a problem far too complicated to be grasped by the empirical understanding, operating even under the most ingenuous motives.

Therapeutics.—*Externally and Locally.*—ALCOHOL is an efficient application for *contusions*, *sprains*, and *indolent ulcers*, and is also serviceable in hardening the skin and preventing the formation of *bed-sores*. It is a useful hemostatic to check *capillary oozing*, and, being a powerful antiseptic, is available in all *wounds*. *Uterine hemorrhage* is controlled by inserting in the cavity of the uterus a tampon saturated with the drug.

Its local anesthetic properties render alcohol valuable in relieving irritation of the skin in *urticaria*, *frost-bite*, etc.; it also serves as an efficient gargle in *diphtheria* and *acute pharyngitis*.

ALCOHOL, or BRANDY, has been successfully employed to *harden nipples* and prevent their cracking.

A very efficient means of reducing *temperature in fever* is to bathe the skin with ALCOHOL, the method being also useful to check *excessive sweating*.

The *absorption of inflammatory exudates* may be aided and the *pain of muscular rheumatism* relieved by rubbing the affected area with TINCTURE OF CAMPHOR or SOAP LINIMENT, both of which contain alcohol.

Internally.—ALCOHOL, in the form of WINE, BEER, or ALE, taken before or during meals, is an efficient stomachic. *Atonic dyspepsia* and the *weakened digestion* attendant upon *convalescence from acute diseases* are greatly benefited by some form of alcohol. When digestion becomes impaired as the result of physical or mental exhaustion the drug serves a useful purpose as a tonic.

The wisdom of using the drug, however, in the above conditions may be questioned, because of the danger of establishing the

desire or habit, particularly in the case of neurotic women and those whose debilitated energies call for renewed and increasing quantities of the drug.

Frequently the physical or mental depression, the peculiar, irresistible craving for stimulants, the insomnia and fitful appetite and disposition which urge recourse to alcoholic indulgence, are but the early manifestations of a brain-and-nerve degeneration, the impulse to drink being only the physical demand for relief.

There is less danger attending the administration of alcohol in conditions of lowered vitality and weakened digestion in old people than in the young and middle-aged. The drug is decidedly contra-indicated in persons of average health and fair digestion, although beneficial in the aged, whose powers are failing from natural decline.

The anesthetic and sedative properties of alcohol, especially in the form of CHAMPAGNE, which contains carbon-dioxide gas, may frequently control *obstinate vomiting*. *Gastralgia* and the *pain arising from flatulence* are often readily relieved by BRANDY, and the same remedy may be used efficiently in checking *simple diarrhea*.

As a pure cardiac stimulant, alcohol is remarkably serviceable in *syncope*, *asphyxia*, *exhausting hemorrhages*, *diphtheria*, and *collapse* where death seems imminent. In counteracting the *effects of narcotic poisons* it is almost indispensable; it is, moreover, undoubtedly the most efficient antidote to the *poison of venomous reptiles*.

It is a common practice with some surgeons to precede the inhalation of chloroform with the administration of 1 or 2 ounces (30.0–60.0 Cc.) of WHISKEY or BRANDY, for the twofold purpose of sustaining the heart and prolonging the anesthesia.

In certain stages of various acute diseases, such as *typhoid*, *typhus*, *small-pox*, *pneumonia*, *cerebro-spinal meningitis*, *capillary bronchitis*, etc., alcohol is one of the most potent and valuable remedies. It should be employed in these cases only when there is marked depression of the circulatory apparatus, characterized by a weak, rapid, soft, and irregular pulse, with a feeble sound of the heart and threatened syncope or delirium.

Alcohol is beneficial in such cases as the foregoing when by its use the tongue is moistened, the pulse and respiration is slowed, the restlessness and delirium quieted, and the skin becomes less parched.

Should the drug increase the pulse and intensify the nervous manifestations, it is an indication that the dosage is excessive, in which event it may be well to discontinue the administration altogether. Even where the action of the drug is favorable, it is doubtful whether it should ever be given in fevers throughout the twenty-four hours, administration being advisable rather when the muffled or absent first sound of the heart indicates impending cardiac failure. This usually occurs during the interval between midnight and 7 A.M. Stimulation should therefore begin before midnight, and full doses—say 1 fluidounce (30 Cc.)—be given every three hours, full doses being of more service than repeated smaller amounts.

It should be remembered that alcohol generates no new energy, but simply enables a person to utilize in a short period all his available reserve force. The utmost discrimination and judgment are requisite to the proper administration of the drug.

In *pyemia*, *septicemia*, *erysipelas*, and *diphtheria* alcohol is frequently one of our most efficient remedies, while clinical experience has fully demonstrated its value in retarding the progress of *phthisis*. Tubercular patients acquire a marked tolerance for the drug, being often able to assimilate enormous quantities without deleterious results.

Small quantities of alcohol appear to exert a favorable action in *functional impotence*.

Its sedative action, or possibly its property of increasing intracranial blood-pressure, renders alcohol valuable as a hypnotic in *neurasthenia*.

A very common remedy for *anemia* and *chlorosis* is RED WINE.

Acute coryza or a *cold* may often be wholly aborted by taking a good quantity of hot WHISKEY or hot "GIN SLING" upon retiring.

The statement made by so prominent a physician as Mr. Lawson Tait, "I am fully persuaded, after thirty years of life as hard in work and as full of responsibility as well could be, that the moderate use of alcohol is a necessity in our modern life," is, in the author's opinion, too strong. Physicians, of all men, should realize the ill effects of over-work, as well as those of alcohol. Is it not wiser to limit the amount of labor than to attempt undue exertion under the stimulus of so seductive and dangerous a drug? Statistics show that of those addicted to the excessive use of alcohol and other pernicious drugs, by far the largest percentage is among

physicians—a sad commentary on their wisdom and professional knowledge.

Contraindications.—Alcohol should not be given when the urine is of high specific gravity. It is ordinarily contraindicated in nephritis and diseases of the liver, gout, gleet, gonorrhea, and urethritis. The malt liquors and sweet wines should not be given in diabetes nor to persons suffering from eczema. Alcohol is also dangerous in hypertrophy of the heart and excessive cardiac action.

Administration.—When possible, alcohol should always be taken with food. Brandy is the best astringent, and brandy and champagne are the best preparations to allay nausea. Whiskey is the least constipating, and gin the most diuretic. As regards their sedative action, there is no preference, whichever is most agreeable to the patient and least affects the head being advisable. As stomachics either claret, beer, or ale is most efficacious in improving the appetite. In cases of fermentative dyspepsia sweet wines and malted liquors are more injurious than beneficial, whiskey or brandy being preferable.

When desired as diffusible stimulants in cases of cardiac failure brandy or whiskey only should be employed, which preparations may be given hypodermically.

PREPARATIONS OF AMMONIUM.

Aqua Ammōniæ Fŏrtior—Aquæ Ammōniæ Fortiōris—Stronger Ammonia Water. *U. S. P.*

Origin.—An aqueous solution of ammonia ($NH_3 = 17.01$), containing 28 per cent. by weight of the gas.

Description and Properties.—A colorless, transparent liquid, having an excessively pungent odor and a very acrid and alkaline reaction. It should be kept in strong, glass-stoppered bottles.

Dose.—3–6 minims (0.18–0.3 Cc.).

Official Preparation.

Spĭritus Ammōniæ—Spĭritus Ammōniæ—Spirit of Ammonia.—*Origin.*—An alcoholic solution of ammonia, containing 10 per cent. by weight of the gas.

Description and Properties.—A colorless liquid, having a strong odor of ammonia and a specific gravity of about 0.810 at 15° C. (59° F.). It should be kept in glass-stoppered bottles, in a cool place.

Dose.—10–60 minims (0.6–3.7 Cc.).

Āqua Ammōniæ—Āquæ Ammōniæ—Ammonia Water. *U. S. P.*

Origin.—An aqueous solution of ammonia, containing 10 per cent. by weight of the gas.

Description and Properties.—A colorless, transparent liquid, having a pungent odor, an acrid, alkaline taste, and a strongly alkaline reaction. It should be kept in glass-stoppered bottles, in a cool place.

Dose.—10–20 minims (0.6–1.2 Cc.) well diluted.

Official Preparations.

Linimĕntum Ammōniæ—Linimĕnti Ammōniæ—Ammonia Liniment (Ammonia Water, 350; Alcohol, 50; Cotton-seed Oil, 600).—For external use.

Spĭritus Ammōniæ Aromăticus—Spĭritus Ammōniæ Aromătici. See *Ammonium Carbonate.*

Ammōnii Carbōnas—Ammōnii Carbonātis—Ammonium Carbonate. *U. S. P.*

Origin.—Prepared by subjecting to sublimation and resublimation a mixture of Ammonium Sulphate or Chloride and Calcium Carbonate.

Description and Properties.—White, hard, translucent, striated masses, having a strongly ammoniacal odor without empyreuma, and a sharp, saline taste. On exposure to air the salt loses both ammonia and carbonic acid, becoming opaque, and is finally converted into friable, porous lumps or a white powder. Slowly but completely soluble in about 5 parts of water; decomposed by hot water, with the elimination of carbonic acid and ammonia.

Ammonium carbonate should be kept in well-stoppered bottles, in a cool place.

Dose.—2–15 grains (0.12–1.0 Gm.).

Official Preparation.

Spĭritus Ammōniæ Aromăticus—Spĭritus Ammōniæ Aromătici—Aromatic Spirit of Ammonia (Ammonium Carbonate, 34; Ammonia Water, 90; Oil of Nutmeg, 1; Oil of Lemon, 10; Alcohol, 700; Oil of Lavender Flowers, 1; Water, to make 1000).—*Description and Properties.*—A nearly colorless liquid when freshly prepared, but gradually acquiring a somewhat darker tint. It has a pungent, ammoniacal odor and taste. It should be kept in glass-stoppered bottles, in a cool place.

Dose.—½–2 fluidrachms (1.8–7.3 Cc.).

Antagonists and Incompatibles.—The cardiac sedatives are

antagonistic. The incompatibles are the vegetable and mineral acids, the earthy salts, lime water, and solutions of acidulous salts.

Synergists.—Cardiac and diffusible stimulants, antispasmodics, and capsicum internally. The local action of ammonium preparations is enhanced by cantharides and counter-irritants.

Physiological Action.—*Externally and Locally.*—When solutions of ammonia are applied to the skin or mucous membranes they act as irritants, rubefacients, or vesicants according to the strength of the solution and the freedom or confinement of the vapor.

When inhaled the vapor occasions great irritation of the respiratory passages, together with a sense of suffocation and spasmodic closure of the glottis. There are also produced marked irritation of the conjunctivæ, lacrymation, and a watery secretion from the nose.

Internally.—Digestive System.—Small doses act like alkalies upon the gastro-intestinal tract, augmenting the flow of gastric juice when given before meals and neutralizing it when given after meals.

Excessive doses occasion violent and destructive inflammation of the mouth, esophagus, and stomach, possibly resulting in stricture of the esophagus and stenosis of the pyloric orifice.

Circulatory System.—These preparations, whether ingested or injected into the system, cause a temporary fall of arterial pressure, quickly followed by a decided increase and acceleration of the pulse, owing to nervous stimulation of the heart. Their precise action upon the blood is not known, though they certainly lessen the oxygen-carrying power of the red corpuscles and diminish the tendency to coagulation of the blood.

Nervous System.—Other than their action upon the sensory nerves when locally applied, these preparations affect the nervous system only in stimulating the motor centers of the spinal cord, excessive doses causing convulsions similar to strychnine.

Respiratory System.—They stimulate the respiratory center, greatly increasing the number of respirations.

Absorption and Elimination.—The preparations of ammonium are rapidly absorbed, being oxidized in the system and eliminated chiefly by the kidneys, increasing the acidity of the urine and augmenting its amount, as well as increasing the proportion of nitric acid, uric acid, and urea excreted. The continued use of ammonium preparations therefore promotes tissue-waste.

Temperature is unaffected by medicinal amounts.

Poisoning.—In toxic doses these preparations are powerful corrosive poisons, exciting violent inflammation of the gastro-intestinal tract, labored respiration, great cardiac depression, muscular weakness, and possibly convulsions.

Treatment of Poisoning.—Similar to that of poisoning by the corrosive alkalies—evacuation of the stomach, the internal administration of vinegar or other vegetable acids, followed by oil and demulcent drinks, opium being indicated for the relief of pain.

Therapeutics.—AQUA AMMONIÆ is a valuable ingredient of "hair tonics" in *premature alopecia.* The AMMONIA LINIMENT is a favorite remedy for *chilblains.*

The AROMATIC SPIRIT OF AMMONIA is of value in many diseases of the scalp, such as *pityriasis*, etc., and, when well diluted with water, has been recommended in *acute pharyngitis.* The AMMONIUM CARBONATE possesses an action similar to that of salicylic acid in its property of dissolving epidermic scales, rendering it of value in preparing the skin for the subsequent local treatment of *psoriasis.*

As a counter-irritant AMMONIA WATER—or, preferably, the AMMONIUM LINIMENT—is efficient in *chronic rheumatism* and *joint affections.*

AMMONIA WATER relieves the irritation caused by *bites of insects;* its vapor inhaled acts as a rapid restorative in cases of *fainting.*

Internally.—The ammonium preparations here mentioned are serviceable in lessening excessive *acidity of the stomach.* The AROMATIC SPIRIT OF AMMONIA is frequently beneficial in allaying the distress of *nervous headache*, and is also an efficient remedy to counteract the *effects of an immoderate use of alcoholic stimulants*, having proved in many cases valuable in the treatment of *delirium tremens.*

The most important uses of these preparations are, perhaps, as powerful diffusible stimulants to the circulatory, respiratory, and spinal systems. They are of undoubted value in sudden *cardiac failure* arising from any cause, such as *poisoning from chloroform, noxious gases, hydrocyanic acid*, etc. Taken internally or by intravenous injection, they counteract the poisonous effects resulting from the *bites of venomous reptiles.*

The CARBONATE is an excellent stimulant to sustain the heart and respiration during the course of *pneumonia, eruptive* and *continued fevers*, etc. In all dynamic conditions of the heart this preparation should be given in small doses, frequently repeated.

The carbonate is also a valuable stimulant expectorant in *chronic bronchitis* and *broncho-pneumonia.*

The preparations of ammonia have been recommended in *threatened thrombosis.* The condition being established, however, it should be noted that the method of treatment by intravenous injection, advocated by some authorities, is at best a very dubious procedure.

Contraindications.—Acute gastritis and conditions of excessive acidity of the urine. Conditions of anemia and great emaciation would contraindicate the prolonged use of these preparations.

Administration.—The liquid preparations should always be well diluted, and the carbonate should invariably be given in solution. The fluid extract of glycyrrhiza disguises the taste very well.

Owing to the rapid elimination of these drugs, the dosage should be frequently repeated.

GROUP IX.—CARDIAC SEDATIVES.

Aconītum—Aconīti—Aconite. *U. S. P.*

Origin.—The tuber of *Aconitum Napellus* L., a plant about 40 inches (1 M.) high, met with throughout the greater portion of Asia and Europe, mostly in mountainous regions.

Description and Properties.—From $\frac{2}{5}$ to $\frac{4}{5}$ inch (10–20 Mm.) thick at the crown, and from 2 to 3 inches (50–75 Mm.) long, with scars or fragments of radicles; dark brown externally, whitish internally; with a rather thick bark, the central axis about seven-rayed; without odor, taste at first sweetish, soon becoming acrid, and producing a sensation of tingling and numbness lasting for some time. It contains an acrid alkaloid, *aconitine.*

Dose.—$\frac{1}{2}$–2 grains (0.03–0.12 Gm.).

Official Preparations.

Extrăctum Aconīti—Extrăcti Aconīti—Extract of Aconite.—*Dose,* $\frac{1}{10}$–$\frac{1}{4}$ grain (0.006–0.01 Gm.).

Extrăctum Aconīti Flūidum—Extrăcti Aconīti Flūidi—Flūid Extract of Aconite.—*Dose,* $\frac{1}{10}$–2 minims (0.006–0.12 Cc.).

Tinctūra Aconīti—Tinctūræ Aconīti—Tincture of Aconite.—*Dose,* $\frac{1}{2}$–5 minims (0.008–0.3 Cc.).

Unofficial Preparation.

Fleming's Tincture of Aconite is nearly twice as strong as the official tincture, the dose being correspondingly smaller.

Aconitīna—Aconitīnæ—Aconitine. (UNOFFICIAL.)

Origin.—An alkaloid principle extracted from Aconite.

Description and Properties.—The alkaloid exists in two forms, crystalline and amorphous; white or yellowish-white, odorless, with a strong acrid taste characteristic of aconite. The crystalline form is soluble in alcohol, ether, and chloroform, and partially so in water.

The alkaloid is one of the most powerful of poisons, rivalling in virulence hydrocyanic acid. The various aconitines are of different strengths, so that only the minimum dose of a new sample should at first be employed.

Dose.—$\frac{1}{1000}$–$\frac{1}{250}$ grain (0.00006–0.00025 Gm.).

Oleātum Aconitīnæ—Oleāti Aconitīnæ—Oleate of Aconite.—A 2 per cent. solution of Aconitine in Oleic Acid. For external use.

Antagonists and Incompatibles.—Digitalis and other cardiac stimulants, including atropine and ether, antagonize the action of aconite.

Synergists.—All members of this group and cold enhance the action of the drug.

Physiological Action.—*Externally and Locally.*—Applied to mucous membranes or to the skin for any length of time, aconite first stimulates and then depresses the ends of the sensory nerves, producing respectively tingling, numbness, and local anesthesia.

Internally.—Digestive System.—Except when given in very dilute solutions, aconite produces tingling and numbness of the lips and mouth, with increased secretion from the salivary glands. Large doses cause great irritation, together with a sense of constriction in the fauces.

Under normal conditions of the stomach aconite may act upon that organ as a sedative, augmenting its secretions. Large doses may occasion pain, nausea, and vomiting.

Circulatory System.—Aconite causes a marked slowing of the heart's action, due to stimulation of the vagus center in the medulla. Following the slowing of the heart, due to vagus action, aconite has a direct action on the heart-muscle, increasing its irri-

tability, causing it to become very rapid and weak, eventually occasioning delirium cordis through over-stimulation. Death usually occurs from cardiac paralysis, the heart being arrested in diastole. The arterioles are contracted, owing to stimulation of the vasomotor center in the medulla; but because of this action, occasioning a marked slowing of the heart, there is a great decrease of blood-pressure. Moreover, the contractive action of the vasomotor center is somewhat counteracted by its primary stimulation of the cutaneous nerves, resulting in dilatation of the peripheral vessels and consequent flushing of the skin.

Nervous System.—Excessive doses of aconite cause a slight stimulation of the sensory nerve-endings, finally followed by depression, the muscles passing into a state of paralysis, probably occasioned by direct action upon the muscle-tissue.

Respiratory System.—The respiration is slowed by moderate doses; under large doses it is rendered both shallow and slow. The breathing is retarded, because the peripheral endings of the vagi distributed to the lungs are depressed. Under large doses there is depression of the respiratory center, paralysis of which may be occasioned by lethal amounts.

Absorption and Elimination.—Aconite is rapidly absorbed, but its channels of elimination are not definitely known, although it is probably excreted by the kidneys, and to some extent by the skin, the drug acting as a mild diaphoretic.

Temperature.—Aconite is alleged to be a decided antipyretic, the reduction of temperature being due to various causes: (1) the slowing of the circulation, diminishing the metabolism; (2) the peripheral action of aconite, causing dilatation of the cutaneous blood-vessels; (3) the depressing action of the drug upon all muscle-tissue.

Eye.—Toxic amounts of the drug have produced mydriasis, misty vision, and diplopia.

Untoward Action.—Besides the symptoms described under "Poisoning," there have been observed pustular and erythematous eruptions, vertigo, and dimness of vision.

Poisoning.—The first effect of toxic doses is to cause marked tingling of the tongue and lips, which sensation soon extends to the fingers and may even affect the entire cutaneous surface. There is extreme muscular weakness, particularly noticeable in the lower extremities. The pulse, at first slow and weak, soon becomes rapid and almost imperceptible. The respirations are quite feeble and shallow, and there may be marked dyspnea.

The countenance is anxious and the skin pallid, cold, and covered with sweat, with great reduction of temperature. These symptoms are accompanied by dimness of vision, the pupils usually being widely dilated. Rarely there are present epileptiform convulsions.

Death may be postponed for some time, or it may rapidly follow a lethal dose.

Treatment of Poisoning.—The patient should be placed in a horizontal position, better with the feet raised slightly. The stomach should be thoroughly evacuated; bodily heat should be maintained by external warmth; diffusible stimulants, such as ether, alcohol, and spirits of ammonia should be given hypodermically, the treatment being followed by administration of digitalis. Atropine and strychnine hypodermically are indicated to stimulate the respiration and assist in stimulating the heart.

Therapeutics.—*Externally and Locally.*—Whether locally applied or given internally ACONITE is an excellent remedy in *neuralgiæ*, particularly in *tic douloureux*. The TINCTURE, ACONITE LINIMENT, or an OINTMENT OF ACONITINE may be applied to the course of the affected nerve. The TINCTURE OF ACONITE frequently proves beneficial in *herpes zoster*, *chilblain*, *pruritus*, etc., and its extended application has even been recommended to ally the pain of *chronic rheumatism*.

Internally.—ACONITE is an exceedingly efficacious remedy in many febrile diseases, particularly the *sthenic fevers* of children and those fevers resulting from inflammation, such as *tonsillitis*, *laryngitis*, *pharyngitis*, *quinsy*, etc. The drug seems to exert a peculiarly beneficial influence on mucous membranes, all acute inflammatory conditions of the throat, bronchial tubes, or intestinal canal —characterized by fever, a small, wiry pulse, and rapid cardiac action—being greatly improved by the remedy.

As previously indicated, aconite is one of the most efficient sedatives in the *irritative fevers of children*. It is equally valuable in the *first stage of pneumonia* and in *pleurisy*, and is an invaluable adjunct to opium in the treatment of *peritonitis*.

Pericarditis is often favorably influenced by this drug, while it is also of great service in allaying *nervous palpitation* of the heart or that due to *excessive cardiac hypertrophy*.

The injection into the rectum of 8 or 10 minims (0.5–0.6 Cc.) of the TINCTURE OF ACONITE, while perhaps producing a slight prolapsus of the rectum, quickly affects an *irritable stricture of the urethra*, so that a catheter may be passed with little difficulty, although the operation may have been previously found impossible.

Probably there is no better combination to "break up a *cold*" than aconite and Dover's powder, the TINCTURE OF ACONITE, given at frequent intervals for a few hours, being followed, preferably at bed-time, with 8 or 10 grains (0.5–0.6 Gm.) of Dover's powder.

ACONITE has been favorably recommended in the acute stages of *cerebro-spinal meningitis* and as a cardiac sedative in *aneurysm.*

Contraindications.—Aconite is always contraindicated in sub-acute or chronic conditions or when the heart's action is weak. It is also intolerable in catarrhal conditions of the stomach.

Administration.—A good, reliable tincture is the best preparation for internal use. Moreover, better results are obtained by giving the drug in fraction of minim doses—from $\frac{1}{10}$ to $\frac{1}{2}$ minim (0.006–0.03 Cc.) in a teaspoonful of water every fifteen minutes—than by larger dosage. The most desirable influence of the drug appears to be realized by this method.

Verātrum Vīride—Verātri Vīridis—Veratrum Viride.

U. S. P.

(AMERICAN HELLEBORE.)

Origin.—The rhizome and roots of *Veratrum viride* Solander, a plant growing in swampy places and damp thickets in Canada, and in the United States as far south as Georgia. The plant closely resembles V. album of Europe, and is also allied to a species found in Eastern Siberia.

Description and Properties.—Rhizome upright, obconical, simple or divided, from 2 to 3 inches (50 to 75 Mm.) long; externally blackish-gray, internally grayish-white, showing numerous short, irregular wood-bundles. Many shrivelled, light yellowish-brown roots issue from all parts of the rhizome.

The drug is inodorous, but strongly sternutatory when powdered, the taste being bitterish and very acrid.

Veratrum viride contains the following alkaloids: *jervine*, *pseudojervine*, *rubijervine*, and *cevadine*. The first named is the cardiac depressant principle of the drug, and the remaining three are sternutatory.

Veratrina (U. S. P.) is not found in this drug, as formerly supposed, Sabadilla being its principal source. Veratroidine, once supposed to be a distinct alkaloid, is probably only a mixture of rubijervine and a toxic resin.

Dose.—$\frac{1}{4}$–5 grains (0.01–0.3 Gm.).

Official Preparations.

Extrăctum Verătri Vĭridis Flŭidum—Extrăcti Verătri Vĭridis Flŭidi—Fluid Extract of Veratrum Viride.—*Dose*, ¼–5 minims (0.01–0.3 Cc.).

Tinctūra Verătri Vĭridis—Tinctūræ Verătri Vĭridis—Tincture of Veratrum Viride (40 per cent.).—*Dose*, ¼–5 minims (0.01–0.3 Cc.).

Allied Drugs.

Verătrum Ălbum—Verătri Ălbi—White or European Hellebore.

Sebadĭlla—Sebadĭllæ—Cevadilla.

The seeds of this plant yield the following official alkaloid, known as Veratrine:

Veratrīna—Veratrīnæ—Veratrine. *U. S. P.*

Description and Properties.—A white or grayish-white, amorphous or semi-crystalline powder; odorless, but causing intense irritation and sneezing whenever even a minute quantity reaches the mucous membrane; of an acrid taste, and leaving a sensation of tingling and numbness on the tongue; permanent in the air; very slightly soluble in hot or cold water, soluble in 3 parts of alcohol.

Dose.—$\frac{1}{40}$–$\frac{1}{4}$ grain (0.0016–0.016 Gm.).

Official Preparations.

Oleātum Veratrīnæ—Oleāti Veratrīnæ—Oleate of Veratrine (2 per cent.). For external use.

Unguĕntum Veratrīnæ—Unguĕnti Veratrīnæ—Veratrine Ointment (4 per cent.). For external use.

Antagonists and **Incompatibles** and **Synergists** are the same as for Aconite.

Physiological Action.—The following remarks refer only to the crude drug, the actions of *Jervine*, the mixture *Veratroidine*, and *Veratrine* being given separately.

Externally and Locally.—Veratrum is more of an irritant than aconite, exciting some inflammation of the skin when applied locally, and when in contact with the nasal mucous membrane producing violent sneezing.

Internally.—Its effects are in every respect analogous to those of aconite, with the following exceptions, in the several systems:

Digestive System.—Veratrum is more apt to occasion nausea and vomiting.

Circulatory System.—The drug is a more powerful depressant to the circulation, small doses, while not materially affecting the

pulse-rate, greatly reducing its force, large doses rendering the pulse very weak, almost indistinguishable, and very rapid.

Nervous System.—It does not, as does aconite, affect the sensory nerves, but in large doses paralyzes the motor system centrally, impairing the reflexes. Under moderate doses there is extreme muscular weakness.

Respiratory System.—Veratrum depresses the respiration less than aconite.

Absorption and Elimination.—The drug is absorbed with great facility, and is eliminated chiefly by the bowels. It possesses much feebler diuretic and diaphoretic properties than aconite.

Temperature.—In medicinal doses it is not so powerful an antipyretic as aconite.

Untoward Action.—Veratrum occasionally produces an erythematous or pustular eruption.

Poisoning.—Except that the drug causes no cutaneous anesthesia or diminution of sensation, the symptoms of poisoning are almost identical with those occasioned by aconite.

Treatment of Poisoning.—The same as prescribed for aconite.

The **Physiological Actions** of jervine, veratroidine, and veratrine are as follows:

Externally and Locally.—JERVINE is a mild irritant when applied to the skin or mucous membranes. VERATROIDINE is less irritating when similarly applied. VERATRINE is a powerful irritant when applied by inunction, producing a tingling or prickling sensation, followed by pain and finally by numbness.

Internally.—Digestive System.—JERVINE has no noticeable effect upon the stomach and bowels, but produces marked salivation. VERATROIDINE in full doses occasions vomiting and purging. VERATRINE excites great irritation of the gastro-intestinal tract, causing profuse salivation, with vomiting and purging and severe epigastric pain.

Circulatory System.—JERVINE renders the pulse slower, softer, and fuller, with marked reduction of arterial pressure. This action is due to direct depression of the cardiac muscle or of the motor ganglia, the dilatation of the arterioles being the result of a depressant effect upon the vaso-motor center.

VERATROIDINE retards the heart's action by stimulating the pneumogastrics. The arterial pressure is lowered by weakening of the heart. The vaso-motor center is not depressed, nor are the arterioles dilated.

VERATRINE markedly retards cardiac action, lengthening the diastolic period. The blood-pressure is decreased.

Nervous System.—JERVINE causes great muscular weakness, with abolition of reflexes, owing to its depressing action upon the motor areas of the spinal cord. Upon the cerebral motor areas, however, its influence is that of a stimulant, so that poisonous doses of this alkaloid produce convulsions of cerebral origin. The muscles themselves and the motor nerves are unaffected, though in the later stage of poisoning numbness is present, showing that some portion of the sensory mechanism is depressed.

VERATROIDINE manifests the same action as jervine.

VERATRINE.—This alkaloid affects neither the brain nor the spinal cord. The motor and sensory nerves, on the other hand, betray its influence, being first stimulated and then paralyzed.

The pain primarily produced by the local application of veratrine is due to excessive stimulation of the peripheral endings of the sensory nerves.

Respiratory System.—JERVINE is a powerful depressant to the respiration, death occurring from asphyxia when lethal doses are taken.

VERATROIDINE affects the system in like manner with jervine.

VERATRINE.—Small doses accelerate the respiratory movements. Large doses retard and finally arrest respiration—the former amounts acting as stimulants, and the latter causing paralysis of the respiratory center.

Temperature.—Moderate amounts of JERVINE and VERATROIDINE have no marked effect upon, while poisonous doses depress, temperature.

VERATRINE in large doses is more of an antipyretic than either jervine or veratroidine.

Poisoning.—The symptoms of poisoning from either one of the above alkaloids would be a combination of the effects produced by lethal amounts, as stated, separately.

Treatment of Poisoning.—The same as prescribed under Veratrum Viride.

Therapeutics.—*Externally and Locally.*—VERATRUM VIRIDE is seldom, if ever, used locally. VERATRINE, though in rare cases given internally, is wellnigh restricted to external or local application.

The OLEATE OR OINTMENT OF VERATRINE when applied over the affected nerve is exceedingly efficacious in *neuralgia*, particularly

in *tic douloureux* and *orbital neuralgia.* In the latter affection great care should be taken in administration, lest some portion of the drug enter the eye, in which case violent and persistent conjunctivitis would ensue.

Internally.—VERATRUM VIRIDE may be employed for the same conditions for which aconite is recommended, although it is doubtful whether it possesses any advantages over the latter drug; indeed, by many competent physicians it is considered inferior to, and more dangerous than, aconite. Moreover, the nausea and vomiting which in many patients are likely to follow the ingestion of this drug render its use objectionable.

Contraindications.—The same as for aconite.

Administration.—The tincture of veratrum viride only should be given, beginning with small doses, as recommended for aconite, and cautiously increasing the amount. Veratrine may be applied in the form of an ointment, oleate, or in solution together with alcohol and glycerin.

Phytolăccæ Frŭctus—Phytolăccæ Frŭctus—Phytolacca Fruit. *U. S. P.*

Origin.—The fruit of *Phytolacca decandra* L., a perennial herb indigenous in North America, growing in waste places.

Description and Properties.—A depressed-globular, dark-purple compound berry, about ⅓ inch (8 Mm.) in diameter, composed of ten carpels, each containing one lenticular black seed; juice purplish-red, inodorous; taste sweet, slightly acrid. The fruit contains *phytolaccin*, *phytolaccic acid*, tannin, gum, sugar, and a coloring matter.

Dose.—5–30 grains (0.3–2.0 Gm.).

Phytolăccæ Rādix—Phytolăccæ Rădicis—Phytolacca Root. *U. S. P.*

(POKE-ROOT.)

Origin.—The root of *Phytolacca decandra* L.

Description and Properties.—Large, conical, branched, and fleshy; mostly in transverse or longitudinal slices, wrinkled, grayish, hard; fracture fibrous, the wood-bundles in several distinct concentric circles; inodorous; taste sweetish and acrid. It contains resin, gum, fixed oil, tannin, starch, sugar, and a glucosid.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparation.

Extractum Phytolaccæ Radicis Fluidum—Extracti Phytolaccæ Radicis Fluidi—Fluid Extract of Phytolacca Root.—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Antagonists and Incompatibles.—The cardiac stimulants, opium, and ether oppose the action of phytolacca.

Synergists.—All the members of this group; the motor-depressants and emetics also enhance the action of the drug.

Physiological Action.—*Externally and Locally.*—The powdered root is extremely irritating to mucous membranes, in certain subjects occasioning an erythematous eruption and excoriations.

Internally.—Digestive System.—Phytolacca possesses emeto-cathartic properties. It occasions much nausea, with great depression, persisting for some time before vomiting occurs. The drug augments the secretion of bile and acts as a laxative.

Circulatory System.—Like aconite, it reduces the force and frequency of the heart's action and lowers arterial tension.

Nervous System.—Poke-root is a powerful motor depressant, acting as a direct paralyzant to the spinal cord and medulla, although the muscles and motor nerves are unaffected.

Respiratory System.—Phytolacca is a respiratory depressant, rendering the breathing slow and shallow. Toxic doses produce death by paralysis of the respiratory center, preceded by tetanic convulsions.

Absorption and Elimination.—The drug is readily absorbed, and is eliminated chiefly by the kidneys.

Temperature.—Medicinal doses have no effect on temperature.

Poisoning.—The symptoms of poisoning are quite similar to those produced by veratrum, though the nausea and vomiting are postponed longer after the ingestion of phytolacca.

Treatment of Poisoning.—The same as recommended under Aconite and Veratrum.

Therapeutics.—*Externally and Locally.*—Preparations of phytolacca have been successfully used to *allay inflammation*, as in cases of *follicular pharyngitis, tonsillitis, mastitis, ulcers, buboes, burns, abscesses.* The drug is also useful in *chronic eczema, sycosis, favus*, etc. The FLUID EXTRACT may be applied, or the powdered root incorporated in ointment either singly or associated with other medicinal agents.

Internally.—The drug has proved an efficient remedy in *chronic rheumatism*, its alterative properties rendering it also of some service in the treatment of *scrofula, syphilis*, and *chronic diseases of the skin.*

In *mastitis, follicular pharyngitis, tonsillitis,* etc. the internal use of the drug is indicated, mastitis especially often yielding readily to the internal use of the fluid extract, combined with the local application of an ointment containing phytolacca.

It has been recommended in *obesity*, possessing undoubted efficacy in this respect. It is claimed that the proprietary preparation known as "Anti-fat" is a resinoid preparation of the berries.

Contraindications.—The same as for veratrum viride.

Administration.—No special directions are necessary. The powder, tincture, or fluid extract may be given internally; for topical use an ointment may be prepared.

Pulsatĭlla—Pulsatĭllæ—Pulsatilla. *U. S. P.*

Origin.—The herb of *Anemone Pulsatilla* and *Anemone pratensis* L., collected soon after flowering.

Description and Properties.—Leaves radical, petiolate, silky-villous, twice or thrice deeply three-parted or pinnately cleft, with linear, acute lobes, appearing after the large purple flowers; inodorous, very acrid. It contains a peculiar, acrid, crystallizable principle known as *anemonin*.

Dose.—1–5 grains (0.06–0.3 Gm.).

Unofficial Preparations.

Extrăctum Pulsatĭllæ—Extrăcti Pulsatĭllæ—Extract of Pulsatilla.—*Dose*, ½–3 grains (0.03–0.2 Gm.).

Tinctūra Pulsatĭllæ—Tinctūræ Pulsatĭllæ—Tincture of Pulsatilla.—*Dose*, 10–20 minims (0.6–1.2 Cc.).

Anemōnin.—Occurring in crystalline, colorless needles, soluble in warm alcohol, insoluble in water.—*Dose*, ½–⅙ grain (0.05–0.01 Gm.).

Antagonists and Incompatibles and **Synergists** the same as for Aconite.

Physiological Action.—*Externally and Locally.*—Pulsatilla is a decided irritant to the skin, the bruised plant when rubbed upon it even producing vesication. In the mouth it produces a sensation of burning, succeeded by numbness.

Internally.—The action of the drug is identical with that of aconite, though pulsatilla possesses greater emetic properties.

Therapeutics.—The drug may be employed for the same purposes as aconite, though as a cardiac sedative it is less efficient. It has been recommended as a useful emmenagogue.

Ărnicæ Flōres—Ărnicæ Flōrum—Arnica Flowers. *U. S. P.*

Origin.—The flower-heads of *Arnica montana* L., a plant indigenous in the mountainous regions of Europe and Northern Asia, and also found in the northwestern part of America.

Description and Properties.—Heads about 1 to 2 inches (25–50 Mm.) in diameter, depressed-roundish, consisting of a scaly involucre in two rows, and a small, nearly flat, hairy receptacle, bearing about sixteen yellow, strap-shaped, ten-nerved ray-florets and numerous yellow, five-toothed, tubular disk-florets, with slender, spindle-shaped akenes crowned by a hairy pappus. Odor feeble and aromatic; taste bitter and acrid.

Arnica flowers contain a glucosid (?), *arnicin*, a *volatile oil*, capronic and caprylic acids, resins, tannin, etc.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparation.

Tinctūra Ărnicæ Flōrum—Tinctūræ Ărnicæ Flōrum—Tincture of Arnica Flowers (20 per cent.).—*Dose*, 10–30 minims (0.6–2.0 Cc.). Chiefly, however, used externally as a vulnerary.

Ărnica Rādix—Ărnicæ Rădicis—Arnica Root. *U. S. P.*

Origin.—The rhizome and roots of *Arnica montana* L.

Description and Properties.—The rhizome is horizontal, somewhat contorted, 2 to 3 inches (5–7 Cm.) long, and $\frac{1}{8}$ or $\frac{1}{6}$ (3 or 4 Mm.) or less in diameter, externally brown, rough from leaf-scars, internally whitish, with a rather thick bark containing a circle of resin-cells surrounding the short, yellowish wood-wedges, and a large, spongy pith. The roots are numerous, thin, fragile, grayish-brown, with a thick bark containing a circle of resin-cells. Odor somewhat aromatic; taste pungently aromatic and bitter; the constituents the same as those of the flowers.

Dose.—5–30 grains (0.3–2 Gm.).

Official Preparations.

Extrăctum Ărnicæ Rădicis Flūidum—Extrăcti Ărnicæ Rădicis Flūidi—Fluid Extract of Arnica Root.—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Extrăctum Ărnicæ Rădicis—Extrăcti Ărnicæ Rădicis—Extract of Arnica Root.—*Dose*, 2–5 grains (0.13–0.3 Gm.).

Emplăstrum Ărnicæ—Emplăstra Ărnicæ—Arnica Plaster (33 per cent. of extract). For external use.

Tinctūra Ărnicæ Rădicis—Tinctūræ Ărnicæ Rădicis—Tincture of Arnica Root (10 per cent.).—*Dose*, 20–30 minims (1.3–2.0 Cc.).

Antagonists and **Incompatibles** and **Synergists** are the same as for Aconite.

Physiological Action.—*Externally and Locally.*—The local action of both the root and flowers is irritant, that of the latter being the more powerful. Occasionally tincture of arnica flowers produces marked inflammation of the skin, resembling erysipelas.

Internally.—The internal effects of arnica are as yet imperfectly understood, it being difficult to assign the drug to its proper group.

Digestive System.—Small doses slightly stimulate the digestive apparatus. Large amounts produce nausea, vomiting, and diarrhea of a choleraic character.

Circulatory System.—Small doses stimulate the heart and increase arterial pressure; full or large doses retard the pulse and depress the circulation.

Nervous System.—Large amounts cause headache, with great depression of the nerve-centers. Toxic amounts occasion motor and sensory paralysis, coma, at times convulsions, collapse, and death.

Respiratory System.—The respiration is slowed, although under small doses there may be temporary acceleration.

Absorption and Elimination.—The active principle of arnica diffuses readily into the blood, the drug being eliminated chiefly by the kidneys, though the skin shares in the excretory process.

Temperature.—Large doses cause a reduction of temperature.

Untoward Action.—The topical application of arnica may cause in susceptible persons violent cutaneous inflammation and the production of pustules, or even distinct bullæ, attended with marked constitutional symptoms. When taken internally the drug occasions a sensation of burning in the mouth and throat, violent pain in the stomach, tenesmus, and choleraic diarrhea, intense headache, and dizziness.

Poisoning.—In addition to the above-named symptoms there are great cardiac depression, decided muscular weakness, slow and shallow respiration, paralysis of the nervous system, and death resulting from collapse.

Treatment of Poisoning.—The treatment should be much the as that prescribed under Aconite. Atropine is probably the siological antidote.

apeutics.—*Externally and Locally.*—ARNICA enjoys a well-

deserved reputation as an efficient remedy for the relief of *bruises*, *sprains*, and *external inflammations* generally. It has been recommended also as a topical application in *myalgic rheumatism*. The local application of the TINCTURE causes the rapid disappearance of *ecchymoses*. Equal parts of the TINCTURE OF ARNICA and glycerin, diluted with water, have been recommended as a stimulant in *inflammation of the mucous membrane of the mouth*.

Internally.—ARNICA is not a very popular remedy for internal administration. It has, however, been used with varying success in *idiopathic mania*, *delirium tremens*, and *rheumatic gout*. It has also been beneficially employed in *exhausting diarrhea*, *chronic dysentery*, *epistaxis*, *hemoptysis*, and *paralysis of the bladder*.

Contraindications.—*Externally* when there exists any acute skin disease; *internally* in cases of inflammation of the gastro-intestinal tract, fatty or valvular disease of the heart, and in all asthmatic conditions.

Administration.—The tincture of arnica is the form generally preferred for external and internal use. In applying any preparation externally the susceptibility to the irritating properties of the drug peculiar to certain persons should be remembered.

Potassii Nitras—Potassii Nitratis—Potassium Nitrate. *U. S. P.*

(NITRE; SALTPETRE.)

Origin.—Purified from native Saltpetre.

Description and Properties.—Colorless, six-sided, rhombic prisms, or a crystalline powder; odorless, and having a cooling, saline, and pungent taste. Permanent in the air. Soluble in 3.8 parts of water, very sparingly soluble in alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparations.

Argenti Nitras Dilutus—Argenti Nitratis Dilūti—Diluted Silver Nitrate.—Used externally.

Chărta Potassii Nitratis—Chărtas (acc.) **Potassii Nitratis—Potassium Nitrate Paper.**—Intended for burning, the fumes to be inhaled.

Antagonists and Incompatibles.—Cardiac and diffusible stimulants antagonize the action of potassium nitrate upon the heart. Mineral acids and metallic salts are incompatible.

Synergists.—The cardiac depressants, diuretics, and agents increasing waste aid the action of potassium nitrate.

Physiological Action.—*Externally and Locally.*—The drug has no important local action.

Internally.—Digestive System.—Large doses occasion nausea and vomiting; poisonous doses produce violent gastro-intestinal inflammation and diarrhea, blood sometimes being vomited and passed with the stools.

Circulatory System.—Small doses have no marked influence on the circulatory system; full doses act as a cardiac depressant, slowing and weakening the pulse; poisonous doses produce great weakness, syncope, and death from cardiac failure.

Nervous System.—No special action is noticeable, although poisonous doses produce tremulousness, insensibility, and convulsions.

Respiratory System.—Large doses retard respiration.

Absorption and Elimination.—Potassium nitrate passes rapidly into the blood unchanged, and is eliminated by the kidneys unchanged. Small doses are actively diuretic, stimulating the renal cells. Large amounts, from too free stimulation, are apt to irritate and inflame the kidneys, even so far as to produce hematuria. The drug is also eliminated to some extent by the skin, being therefore a mild diaphoretic.

Temperature.—Unaffected by medicinal amounts, but lowered by poisonous doses.

Poisoning.—There is violent gastro-intestinal inflammation, with vomiting and purging, blood being present in the ejecta and feces. Other symptoms are—subnormal temperature, coldness of the extremities, a weak and thready pulse, slow and shallow respiration, tremulousness and great muscular weakness, dimness of vision or total blindness, deafness, insensibility, and possibly convulsions. The urine is diminished or suppressed.

Should the patient recover from an immoderate dose of the drug, he suffers for some time from dysuria, irritability of the stomach, colic, muscular weakness, and a sensation of chilliness in the back and limbs.

Treatment of Poisoning.—There is no special antidote for nitre; cases of poisoning, therefore, are to be treated symptomatically, measures for relief including evacuation of the stomach, demulcents, opiates for pain, and cardiac and respiratory stimulants.

Therapeutics.—*Externally and Locally.*—Solutions of this drug have been found serviceable as applications to *bruises* and *abrasions.* The last stage of *pharyngitis* is greatly relieved by a gargle of a

SOLUTION OF POTASSIUM NITRATE, in the proportion of 1 drachm (4.0 Gm.) to 1 pint (473 Cc.) of water.

It is claimed that a paste of POWDERED NITRE and water applied to the face night and morning is an effective method of removing *freckles*.

The difficulty of breathing in cases of *spasmodic asthma* may be greatly relieved by the inhalation of the fumes of burning NITRE-PAPER.

Internally.—The drug was formerly much used in *acute articular rheumatism* and as a refrigerant and sedative in *inflammations*, *pneumonia*, and various *fevers*. It is employed to a considerable extent as a diuretic and diaphoretic, although greatly inferior to the acetates and citrates.

Administration.—It should be given in solution, though the powder is sometimes used in combination with calomel, tartar emetic, or Dover's powder.

The potassium-nitrate paper, as has been stated, should be burned and the fumes arising therefrom inhaled.

Sōdii Nītras—Sōdii Nitrātis—Sodium Nitrate. *U. S. P.*

Origin.—It is found in great quantities imbedded in clay and sand in certain districts of Chili and Peru.

Description and Properties.—Colorless, transparent, rhombohedral crystals, odorless, having a cooling, saline, and slightly bitter taste; deliquescent in moist air. Soluble in 1.3 parts of water and in about 100 parts of alcohol. Sodium nitrate should be kept in well-stoppered bottles.

Dose.—½–1 ounce (15.5–31.0 Gm.).

Physiological Action.—The action of the salt resembles closely that of potassium nitrate, though it is much feebler than the latter drug, while possessing greater purgative properties.

Therapeutics.—*Externally and Locally.*—A solution of the salt possesses some power as a solvent of false membranes, and has been used in the form of a spray to diminish *fibrinous exudations* in the pharynx and larynx.

Internally.—It may be employed for the same purposes as the potassium nitrate, and has been advantageously adopted as a laxative in *diarrhœa* and *dysentery*.

Administration.—Sodium nitrate is best given dissolved in a large quantity of water.

GROUP X.—DIAPHORETICS.

DIAPHORETICS—or *sudorifics*, as they are also called—are medicines which promote diaphoresis or sweating. Their action in stimulating transpiration by the skin may be enhanced by exercise, external warmth, nauseants, and drugs which dilate the vessels, determining more blood to the cutaneous blood-vessels.

Diaphoretics are employed principally for their evacuant, revulsive, and alterative effects, and to promote absorption.

Pilocărpus—Pilocărpi—Pilocarpus. *U. S. P.*

(JABORANDI.)

Origin.—The leaflets of *Pilocarpus selloanus* Engler (Rio Janeiro Jaborandi) and of *Pilocarpus Jaborandi* Holmes (Pernambuco Jaborandi).

Description and Properties.—About 4 to 6 inches (10–15 Cm.) long and ½ to 2½ inches (4–6 Cm.) broad, short-stalked, oval or ovate-oblong, entire and slightly revolute at the margin, obtuse and slightly emarginate, unequal at the base; dull-green, coriaceous, pellucid punctate, mostly smooth; when bruised, slightly aromatic; taste somewhat bitter and pungent.

Pilocarpus contains a *volatile oil* and two alkaloids, *pilocarpine* and *jaborine*, the latter being chemically isomeric with the former, although directly antagonistic in physiological action.

Dose.—5–60 grains (0.3–4.0 Gm.).

Official Preparation.

Extractum Pilocărpi Flūidum—Extracti Pilocărpi Flūidi—Fluid Extract of Pilocarpus.—*Dose*, 5–60 minims (0.3–4.0 Cc.).

Unofficial Preparation.

Infūsum Pilocărpi—Infūsi Pilocărpi—Infusion of Pilocarpus.—*Dose*, 2 fluidrachms–4 fluidounces (8.0–118.3 Cc.).

Pilocarpīnæ Hydrochlōras—Pilocarpīnæ Hydrochlorātis—Pilocarpine Hydrochlorate. *U. S. P.*

Origin.—The hydrochlorate of an alkaloid obtained from Pilocarpus.

Description and Properties.—Small, white crystals, odorless and of a faintly bitter taste; deliquescent on exposure to damp air.

Very soluble in water and in alcohol. It should be kept in small, well-stoppered bottles.

Dose.—$\frac{1}{64}$–$\frac{1}{2}$ grain (0.001–0.03 Gm.).

JABORINE is a yellow, amorphous alkaloid, isomeric with pilocarpine and closely resembling *atropine* in its physiological action. The varying effects which occasionally follow the use of the commercial pilocarpine are due to the presence of jaborine, which antagonizes the action of pilocarpine in almost every particular.

It is highly important, therefore, when administering pilocarpine or any of its preparations to obtain the drugs free from jaborine, which is not used medicinally.

Antagonists and Incompatibles.—Atropine is a perfect physiological antagonist to pilocarpine, being directly opposite in its action throughout its entire range, $\frac{1}{100}$ grain (0.0006 Gm.) being sufficient to counteract $\frac{1}{6}$ grain (0.01 Gm.) of pilocarpine. Morphine relieves the nausea.

The incompatibles are tannic acid, caustic alkalies, and the ferric and metallic salts.

Synergists.—The cardiac depressants, particularly aconite and veratrum viride, gelsemium, sarsaparilla, spirit of nitrous ether, and drugs which paralyze the vaso-motor system, enhance the activity of pilocarpus.

Physiological Action.—*Externally and Locally.*—There is no action of importance.

Internally.—Digestive System.—The action of pilocarpine is here given, since the alkaloid fully represents the drug.

When pilocarpine is taken into the mouth, the ends of the chorda tympani and secretory nerves are stimulated, causing an increased secretion of saliva. Should large doses be taken, there is a feeling of tenderness in the mouth and severe salivation is produced.

The gastric glands are stimulated by the drug, their normal secretion being augmented. By stimulating the unstriped muscle-fibers pilocarpine increases peristalsis, both of the stomach and the intestines, in large doses acting as a cathartic. Immoderate amounts may also induce vomiting. The bile and pancreatic juice are not affected by moderate amounts of the drug.

Circulatory System.—At first the vaso-motor nervous system is depressed, resulting in an acceleration of the cardiac movements, with dilatation of the blood-vessels. The heart, however, is soon slowed and the arterial pressure lowered, so that pilocarpine is in reality a cardiac depressant rather than a cardiac stimulant.

Pilocarpine acts directly upon the heart, either by stimulating

the terminations of the vagus or by depressing the motor centers in the heart-muscle or the muscle itself.

Nervous System.—In medicinal amounts pilocarpine has no perceptible action on the central nervous system, although stimulating the nerve-terminations of involuntary muscles—*i. e.* those of the stomach, intestines, heart, spleen, bladder, uterus, etc.

Poisonous doses have produced (in the frog) tetanic convulsions, followed by paralysis, the result of depression of the muscles and spinal centers, the nerves apparently being unaffected.

Respiratory System.—The respiratory movements are unaffected by medicinal amounts, but the bronchial secretion is augmented.

Absorption and Elimination.—Pilocarpine is rapidly absorbed, and is eliminated principally by the skin, occasioning free, and under large doses excessive, diaphoresis.

The sweat is at first acid, then neutral, and finally alkaline in reaction. The diaphoresis produced by pilocarpine is due to stimulation of the secretory nerves supplying the glands.

The kidneys, under small doses, are stimulated, there being a slight increase in the urine, while in disease the amount of urea is considerably augmented.

The drug is also eliminated by the salivary glands, there being frequently an enormous increase in the salivary secretion. Under the influence of pilocarpine there is an increase in the gastric, bronchial, and lacrymal secretions, even the secretion of milk being notably augmented.

Temperature.—Succeeding a very brief and slight elevation of temperature there is a decided diminution of bodily heat, resulting from the dilatation of cutaneous blood-vessels and the evaporation of the perspiration.

Eye.—Whether applied locally to the eye or taken internally, pilocarpine produces marked contraction of the pupil by stimulating the peripheral endings of the iridal nerves. The drug also produces an increased tension of the eyeball.

Uterus.—There is authority for the statement that pilocarpine stimulates the gravid uterus, inducing uterine contractions or increasing the energy of those already established.

The effect of the drug upon the uterus, however, is more pronounced and apparent in cases of eclampsia, seeming to prove the fallacy of the statement that pilocarpine is a true ecbolic.

Untoward Action.—Nausea and vomiting are of quite frequent occurrence, the vomiting being preceded by long and distressing

nausea. Occasionally the patient complains of severe pain in the urethra and in the lumbar region, with frequent desire to micturate.

There have often been present headache, vertigo, hiccough, dimness of vision, gastric and abdominal pains, stupor, and chilliness. There may occur even collapse.

Poisoning.—The symptoms produced by poisonous doses of pilocarpine are exaggerations of those described above, together with diarrhea, exhausting and excessive sweating and salivation, marked cardiac and respiratory depression, and collapse.

Treatment of Poisoning.—If the drug has been ingested, the stomach should be immediately cleansed with a solution of tannic acid.

To counteract the untoward effects of pilocarpine, whether the drug has been ingested or given by subcutaneous injection, atropine is undoubtedly the most complete physiological antagonist, and should be given hypodermically. Morphine is indicated to control the nausea and vomiting, while some of the cardiac stimulants may be required to counteract cardiac depression.

Therapeutics.—*Externally and Locally.*—PILOCARPINE, or the FLUID EXTRACT OF JABORANDI, has been highly recommended for *alopecia.* By the use of pilocarpine the hair becomes darker. The FLUID EXTRACT OF PILOCARPUS has been employed as a local application in *erysipelas* and *eczema.*

Lozenges containing $\frac{1}{40}$ grain (0.001 Gm.) of PILOCARPINE are efficient in relieving *dryness of the throat.* As a myotic pilocarpine is used in many *diseases of the eye.*

Internally.—The principal internal use of PILOCARPINE is as a diaphoretic in *Bright's disease.* In cardiac dropsy it is not a safe remedy, because of its depressing influence upon the heart.

The drug is very efficient in removing *pleuritic effusion,* while in *uremic poisoning* it is unquestionably the most valuable remedy we possess.

The hypodermic injection of small doses of PILOCARPINE has been highly recommended as an efficient remedy in *erysipelas,* particularly during the first stages of the disease.

The drug has been successfully used to abort *malarial paroxysm,* and has proved beneficial in *tobacco* and *alcoholic amblyopia.*

PILOCARPINE has been found useful in *humid asthma, bronchorrhea,* and *hiccough,* and, in *small doses,* in arresting the *sweating of phthisis* and for the relief of *ptyalism.* The drug is an efficient *galactogogue,* and has been used with success in *mumps, chronic enlargement of the cervical glands,* and *adenitis of the inguinal glands.*

PILOCARPINE materially lessens the flow of urine in *diabetes insipidus*, and in many *diseases of the eye and ear* the internal use of the drug serves a useful purpose.

The property possessed by PILOCARPINE of stimulating the glands of the skin renders this remedy of great service in many *chronic diseases of the skin* characterized by a dry, scaly condition. It is a peculiarly valuable agent in *phthiriasis*, *psoriasis*, certain forms of *eczema*, *pruritus senilis*, etc. PILOCARPINE or FLUID EXTRACT OF JABORANDI may be useful in breaking up a *cold*.

Finally, PILOCARPINE has been highly recommended in *catarrhal jaundice*, and is one of the most efficient antidotes to *belladonna-poisoning*.

Contraindications.—The drug should never be employed when the heart is weak from thinning and atrophy of its walls or from fatty degeneration, nor where there is a tendency to pulmonary congestion and edema. The drug is also contraindicated in asthenic fevers, such as typhoid fever, etc.

Administration.—Pilocarpine is superior to the crude drug, being far more reliable in its action and less liable to produce nausea and vomiting. Pilocarpine is usually given hypodermically, although it is frequently administered by the mouth, in solution, or in troches.

Of all the preparations of the crude drug, the fluid extract and infusion are commonly employed, the latter being less apt to cause profuse salivation. An elixir of pilocarpus is prescribed considerably.

Should preparations of jaborandi be given upon an empty stomach, they are less apt to occasion nausea. This inconvenience may be also avoided by giving an infusion by enema.

Līquor Ammōnii Acetātis—Liquōris Ammōnii Acetātis—Solution of Ammonium Acetate. *U. S. P.*

(SPIRIT OF MINDERERUS.)

Origin.—An aqueous solution of Ammonium Acetate, containing about 7 per cent. of the salt, together with small amounts of Acetic and Carbonic Acids.

Description and Properties.—A clear, colorless liquid free from empyreuma, of a mildly saline, acidulous taste and an acid reaction. This preparation when required should be freshly made.

Dose.—½–1 fluidounce (15.0–30.0 Cc.), in sweetened water.

Official Preparation.

Līquor Fĕrri et Ammōnii Acetātis—Liquōris Fĕrri et Ammōnii Acetātis—Solution of Iron and Ammonium Acetate (BASHAM'S MIXTURE).—Described under "Preparations of Iron."

Antagonists and Incompatibles.—The metallic sulphates, the salts of lead and silver, lime water, the carbonates of potassium and sodium, and acids are incompatible.

Synergists.—Spirit of nitrous ether, potassium citrate, and many of the refrigerants and diaphoretics.

Physiological Action and Therapeutics.—Solution of ammonium acetate is both a mild diaphoretic and diuretic, according as the action is governed by other more powerful agents. For instance, if the skin is warm and the cutaneous blood-vessels dilated, the preparation acts as a diaphoretic, while if the condition of the skin is the reverse, the action of the drug is directed to the kidneys. Should the preparation be given with aconite or spirit of nitrous ether, its action would be that of a diaphoretic, but if the drug were associated with digitalis or squill, it would act as a diuretic. In any case the action of the drug is due to a stimulation of the secretory cells or nerves.

The principal medical use of solution of ammonium acetate is as a diaphoretic in febrile conditions, such as *acute coryza, influenza, acute pharyngitis*, etc. It is a very efficient remedy in *muscular rheumatism*, and in the *eruptive fevers* when the eruption is retarded. It is frequently associated with other remedies in the treatment of *scarlatinous dropsy.*

Owing to its property of stimulating the heart and circulation, the remedy has been recommended in low forms of fever, in the belief that it helps to sustain the powers of life, in lowering the pulse and temperature, moistening the tongue, and quieting the delirium.

In *migraine* and in *alcoholic intoxication* few remedies are so successful, the drug frequently dissipating the effects of acute alcoholism at once.

The remedy has been found efficacious in *dysmenorrhea* and *menorrhagia*, and has been employed externally and locally as a discutient in *mammary engorgements, glandular swellings, contusions, incipient abscesses*, etc.

Administration.—The preparation, as has been said, should be freshly made when wanted, and should be administered well diluted with sweetened water.

Spĭritus Ætheris Nitrōsi—Spĭritus Ætheris Nitrōsi—Spirit of Nitrous Ether. *U. S. P.*

(Sweet Spirit of Nitre.)

Origin.—An alcoholic solution of Ethyl Nitrite, yielding, when freshly prepared and tested in a nitrometer, not less than eleven times its own volume of nitrogen dioxide.

Description and Properties.—A clear, mobile, volatile, and inflammable liquid, of a pale-yellowish or faintly greenish-yellow tint, having a fragrant, ethereal, and pungent odor free from acridity, and a sharp, burning taste. It should be kept in dark amber-colored, well-stoppered bottles, remote from lights and fire.

Dose.—½–2 fluidrachms (2.0–8.0 Cc.).

Antagonists and Incompatibles.—The incompatibles are potassium iodide, ferric sulphate, antipyrine, mucilage of acacia, tincture of guaiacum, and gallic and tannic acids.

Synergists.—Diaphoretics, diuretics, antispasmodics, tincture of aconite, potassium citrate, etc.

Physiological Action and Therapeutics.—When applied to the skin and allowed to evaporate spirit of nitrous ether produces a slight anesthetic effect. Internally, its action is very similar to that of the ammonium acetate. It dilates the blood-vessels more than the latter preparation, besides being more of a diffusible stimulant, stomachic, and carminative.

Like the solution of ammonium acetate, spirit of nitrous ether acts either as a diaphoretic or diuretic, the effect depending upon the manner in which it is administered. For its diuretic action it should be given in ice-water and the patient kept cool; to produce diaphoresis its administration should be accompanied by warm drinks and the patient be well covered.

Spirit of nitrous ether is used for about the same purposes as the solution of ammonium acetate, being particularly serviceable in *febrile affections* to promote critical sweating, employed either alone or in combination with tincture of aconite. It is frequently given as a diuretic in *Bright's disease*, *congestion of the kidneys*, and painful affections of the *urinary apparatus*.

It is a serviceable remedy to relieve *flatulent* distention of the stomach, to allay *nausea*, and to quiet *nervous agitation*. As an antispasmodic the remedy is frequently employed to relieve the pain of *dysmenorrhea*, and it may be inhaled for the relief of *coughing*. It enters into many expectorant mixtures, and is a soothing application to the forehead in *neuralgic headache*.

Administration.—The dose and manner of administering spirit of nitrous ether depend upon the action desired. As an antipyretic in febrile affections it should be given in doses of 20–30 minims (1.30–2.0 Cc.), in sweetened water, every half hour. To produce diuresis the drug should be associated with some other diuretic and given in larger doses, ½–1 fluidrachm (2.0–4.0 Cc.), every three or four hours. If the remedy is desired for its diaphoretic action, it should be given in hot water, in doses of 20 or 30 minims (1.30–2.0 Cc.), repeated every half hour, the patient being well covered.

Should the drug be given as a nervous stimulant, the dose should not be less than 1 fluidrachm (4.0 Cc.).

Care should be exercised in the selection of spirit of nitrous ether that it be reliable and of full strength. If the preparation has been kept in large bottles exposed to light and air, the drug will be more or less inert and should not be prescribed.

GROUP XI.—EMETICS.

EMETICS are agents which produce vomiting or *emesis.*

Vomiting is the result of the following actions: 1. The relaxation of the cardia; 2. The contraction of the pylorus; 3. The contraction of the gastric muscles; 4. The contraction of the diaphragm; 5. The contraction of the abdominal muscles. The effect of these coördinate acts is to compress the stomach, expelling its contents through the relaxed cardia.

The nervous mechanism involved in the act of vomiting is under the control of the medulla. The vomiting center may be stimulated in various ways—reflexly, through the sense of sight or taste, the stomach, peritoneum, biliary passages, kidneys, heart, or lungs, or by irritation of the pharynx or esophagus. The diagram (Fig. 14) serves to explain the mechanism of emesis.

This is the nervous mechanism directly involved in the act of vomiting, regardless of the cause of the emesis. The vomiting center and a portion of the respiratory center intimately connected with it act simultaneously, either by way of the stomach or reflexly through other parts of the body—as is illustrated in certain injuries or diseases—or by direct stimulation of the center by some substance carried to it in the blood.

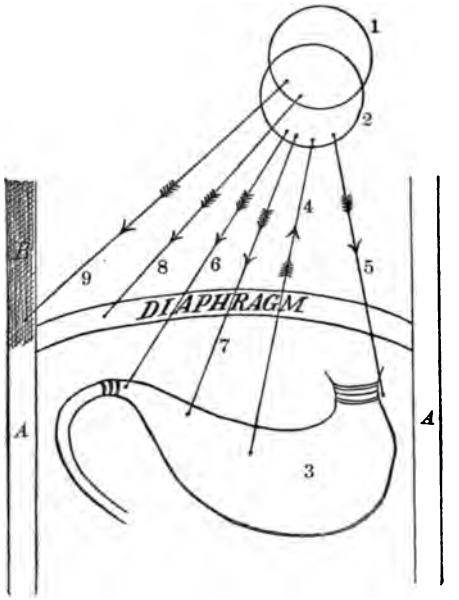

FIG. 14.—*A*, *A*, abdominal walls; *B*, respiratory muscle: 1, respiratory center; 2, vomiting center; 3, stomach; 4, afferent nerve passing from mucous membrane in stomach to vomiting center in medulla; 5, efferent nerve passing from vomiting center to muscular fiber of cardia, relaxing it; 6, efferent nerve passing from medulla to pylorus, contracting it; 7, efferent nerve, influencing gastric muscles to contract; 8, efferent nerve, causing contraction of diaphragm; 9, efferent nerve, causing abdominal muscles to contract.

The Local or Gastric Emetics[1] are—

* Alum;
* Copper Sulphate;
* Zinc Sulphate;
* Yellow Mercuric Sulphate;
* Sodium Chloride;
* Ammonium Carbonate;
* Mustard.

(The drugs marked with an asterisk (*) are considered elsewhere in the present work.)

The Direct or Systemic Emetics are—

Apomorphine Hydrochlorate;
Antimony and Potassium Tartrate;
Ipecacuanha;
Lobelia.

Local or gastric emetics are the more rapid in their action, producing emesis in from two to five minutes. The systemic emetics must be absorbed and pass to the medulla before they produce vomiting, consequently requiring more time to exert their

[1] Some authors reverse the nomenclature, considering those drugs which act only on the stomach "direct," and those affecting the medulla "indirect."

influence. Moreover, the action of the latter class of emetics is of much longer duration and followed by greater depression of the muscular and circulatory systems, together with greater constitutional disturbance.

Some emetics act both locally and centrally. Tartar emetic and ipecacuanha affect the stomach locally, but, since their action is chiefly upon the vomiting center through the circulation, they are classed as systemic emetics. Zinc sulphate and copper sulphate, on the other hand, while to a slight extent acting on the medulla, are classed as local emetics, because their principal action is upon the mucous membrane of the stomach.

Within a few minutes after an emetic has been ingested there is a feeling of nausea and distress, with decided muscular relaxation. The circulatory system is depressed; the pulse is small and irregular, and a sensation of faintness ensues. The flow of saliva is increased, and vomiting soon follows. During emesis the arterial tension is raised, the face is flushed, and there is an increase in bodily heat. When vomiting has subsided there is a reduction of temperature, with cardiac and muscular weakness, the skin being bathed in perspiration. Occasionally fatal syncope has followed the use of emetics.

Antagonists.—Drugs known as Anti-emetics are used to allay nausea and check vomiting. Like emetics, these agents are divided into Local Anti-emetics or Gastric Sedatives and Direct or Systemic Anti-emetics, according to their action.

Among the most important Anti-emetics are the following:

Local Anti-emetics or Gastric Sedatives.

(All save *Ice* are treated elsewhere in the present work.)

Alcohol (especially champagne);
Arsenic (small doses);
Belladonna;
Bismuth subnitrate and subcarbonate;
Carbolic acid;
Cerium oxalate;
Chloroform;
Cocaine;
Creasote;
Calomel (small doses);
Ether;
Ipecac (small doses);
Ice;
Opium;
Hydrocyanic acid;
Menthol;
Potassium nitrate;
Silver nitrate;
Sulphocarbolates;
Tincture of iodine (small doses).

Direct or Systemic Anti-emetics or Gastric Sedatives.

Alcohol;	Chloral;
Ammonium;	Hydrocyanic acid;
Amyl nitrite;	Nitroglycerin;
Bromides;	Opium.

It will be observed that some drugs are both local and direct Anti-emetics.

There are certain measures which may be adopted to allay nausea and relieve vomiting, such as a recumbent posture and injection of large quantities of aërated water into the rectum.

Synergists.—The emetics are of course mutually synergistic. Emetics are adjuncts to antiperiodics and expectorants, although the latter do not particularly enhance the action of the former.

Emetics are used—

1. *To empty the stomach* in cases where the presence of undigested food occasions pain, headache, etc., or to expel some poisonous substance from the stomach. For this purpose the local emetics are preferable.

In cases of poisoning the local emetics are the more reliable.

2. *To remove foreign bodies from the esophagus.* For this purpose the direct or systemic emetics should be used.

3. *To remove foreign bodies from the larynx*, as in cases of membranous croup, laryngeal diphtheria, etc., the effort of vomiting being sometimes sufficient to dislodge and remove the membrane or other foreign substance.

4. *To remove the bronchial secretion* in cases of bronchitis and catarrhal pneumonia. In these cases the direct emetics should be employed, preferably ipecacuanha or apomorphine, because they possess more expectorant properties.

5. *To empty the gall-bladder* in cases of biliousness or malaria, or where small gall-stones are present in the gall-duct, the compression of the liver between the diaphragm and the abdominal muscles expelling the bile from the liver into the duodenum and forcing the gall-stones through the duct.

6. *To relax spasm of the pharyngeal muscles* in cases of spasmodic laryngitis. For this purpose the systemic emetics are preferable.

Contraindications.—Emetics should not be given to persons suffering from aneurysm, hernia, peritonitis, prolapse of the uterus or rectum, atheroma, or where there is very high arterial tension, a

tendency to hemorrhage from the lungs or uterus, or a tendency to abortion.

The emetic drugs which have not been elsewhere discussed in the present work are here given in detail:

Apomorphīnæ Hydrochlōras—Apomorphīnæ Hydrochlorātis — Apomorphine Hydrochlorate. *U. S. P.*

Origin.—The hydrochlorate of an artificial alkaloid prepared from Morphine or Codeine.

Description and Properties.—Minute, grayish-white, shining, acicular crystals, without odor, having a faintly bitter taste, and acquiring a greenish tint upon exposure to light and air. Soluble in about 45 parts of water and about 45 parts of alcohol. It should be kept in small, dark, amber-colored vials. If the preparation imparts to 100 parts of water when slightly shaken an emerald-green color, the drug should be rejected.

Dose.—$\frac{1}{20}$–$\frac{1}{10}$ grain (0.003–0.006 Gm.) by the mouth; $\frac{1}{25}$–$\frac{1}{6}$ grain (0.0025–0.01 Gm.) hypodermically.

Physiological Action.—*Externally and Locally.*—None.

Internally.—Digestive System.—From five to twenty minutes after ingestion—according to the dose and the manner of administration—vomiting ensues, being repeated three or four times at intervals of about fifteen minutes. The emesis is preceded and attended by a slight nausea, with but moderate depression. Apomorphine is a typical direct or systemic emetic, its entire action being exerted upon the vomiting center in the medulla. It is perhaps the most powerful and certain emetic we possess.

Circulatory System.—Small doses have no perceptible effect upon the circulation. Full doses increase the rapidity and force of the heart's action and raise arterial pressure, owing to stimulation of the accelerator nerves and vaso-motor center. Large or toxic amounts depress the circulatory system or paralyze the cardiac muscle.

Nervous System.—Full doses stimulate the brain and may even occasion delirium. Poisonous amounts produce convulsions, probably of spinal origin, succeeded by paralysis of the motor and sensory nerves, and consequently of the muscles.

Respiratory System.—Small amounts do not affect the respiratory movements, although the secretion from the bronchial mucous membrane is increased. Full doses accelerate and deepen respiration, while toxic amounts cause depression.

Absorption and Elimination.—Apomorphine is readily absorbed, and is excreted through the gastro-intestinal tract, as well as by the broncho-pulmonary mucous membrane, the kidneys, and the skin.

Temperature is unaffected by small doses, but may be lowered by large amounts.

Poisoning.—The symptoms would be violent vomiting, delirium or convulsions, and marked cardiac and respiratory depression, death resulting from asphyxia.

Treatment of Poisoning.—The systemic gastric sedatives and cardiac stimulants.

Therapeutics.—Apomorphine is the most reliable emetic to use when prompt emesis is necessary or in cases where swallowing is difficult or impossible.

It is extremely useful as an emetic in cases of *poisoning*, though it frequently happens in narcotic poisoning that the vagus center is so blunted by the poison that apomorphine fails to act.

Should it be necessary to provoke emesis when the stomach is in a state of acute inflammation, apomorphine is preferable to any other emetic.

Given by the mouth in small doses—from $\frac{1}{40}$ grain (0.001 Gm.) to $\frac{1}{20}$ grain (0.003 Gm.) every three or four hours—this drug is an exceedingly efficient remedy in *acute bronchitis.* It is equally beneficial in relieving the dry, hacking cough of *chronic bronchitis, chronic catarrhal pneumonia,* and *tuberculosis.*

Contraindications.—The same as for emetics generally.

Administration.—Apomorphine when given as an emetic should invariably be administered hypodermically, and the solution be always freshly prepared. When the drug is used as an expectorant it should be given by the mouth. Great care should be taken in administering the drug to children, as they bear the remedy very badly.

Antimōnii et Potăssii Tărtras—Antimōnii et Potăssii Tartrātis—Antimony and Potassium Tartrate. *U. S. P.*

(Tartar Emetic; Tartrated Antimony.)

Origin.—Antimony Trioxide is mixed with Acid Potassium Tartrate and Water to the consistence of a paste, allowed to stand for twenty-four hours, boiled in water, and crystallized.

Description and Properties.—Colorless, transparent crystals of the rhombic system, becoming opaque and white on exposure

to air, or a white, granular powder, without odor and having a sweet, afterward disagreeable, metallic taste. Soluble in 17 parts of water and in 3 parts of boiling water, but insoluble in alcohol, which precipitates it from its aqueous solution in the form of a crystalline powder.

Dose.—As an emetic, 1–2 grains (0.06–0.12 Gm.); as a cardiac depressant, ½–1 grain (0.03–0.06 Gm.); as a diaphoretic and expectorant, $\frac{1}{20}$–¼ grain (0.003–0.01 Gm.).

Official Preparations.

Sȳrupus Scillæ Compŏsitus—Sȳrupi Scillæ Compŏsiti—Compound Syrup of Squills (Hive Syrup).—Formula: Fluid Extract of Squill, 80; Fluid Extract of Senega, 80; Antimony and Potassium Tartrate, 2; Sugar, 750; Precipitated Calcium Phosphate, 10; Water, to 1000.

Dose.—5–60 minims (0.3–4.0 Cc.).

Vīnum Antimōnii—Vīni Antimōnii—Wine of Antimony.—Formula: Antimony and Potassium Tartrate, 4; Boiling Distilled Water, 65; Alcohol, 150; White Wine, to 1000.

Dose.—5–60 minims (0.3–4.0 Cc.).

Antagonists and Incompatibles.—Opium, alcohol, and the cardiac stimulants and antispasmodics generally are antagonistic. Tannic and gallic acids and the lead salts are incompatible.

Synergists.—Emetics, cathartics, and cardiac depressants promote the action of tartar emetic.

Physiological Action.—*Externally and Locally.*—Tartar emetic is a powerful irritant when applied to the skin, producing a follicular inflammation followed by a papular eruption, becoming vesicular, and later forming pustules with a central umbilication, desiccation finally occurring, the pustules closely resembling those of small-pox.

Internally.—Digestive System.—Upon the mucous membrane of the gastro-intestinal tract, as upon the skin, antimony and potassium tartrate acts as a powerful irritant. Small doses, occasioning only a sensation of warmth in the stomach, soon produce an increased secretion of saliva and gastric juice, as well as of secretions from the intestines, liver, and pancreas, more or less nausea frequently accompanying these symptoms.

A little larger dosage excites vomiting, due at first to the irritating action of the drug upon the mucous membrane and nerves of the stomach, and, as soon as the drug is absorbed, affecting directly the vomiting center in the medulla. Full or large doses irritate the intestines, producing diarrhea, the discharges, if the dose

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Dose.—5–60 minims (0.3–4.0 Cc.).

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A little larger dosage excites vomiting, due at first to the irritating action of the drug upon the mucous membrane and nerves of the stomach, and, as soon as the drug is absorbed, affecting directly the vomiting center in the medulla. Full or large doses irritate the intestines, producing diarrhea, the discharges, if the dose

has been excessive, strikingly resembling those of cholera. Accompanying the foregoing symptoms are severe cramps and epigastric pain.

Circulatory System.—Tartar emetic is a powerful cardiac depressant, even in small doses slowing and weakening the heart's action, and simultaneously lowering arterial pressure by direct depression of the heart-muscle and of the vaso-motor mechanism in the walls of the blood-vessels.

Poisonous doses of the drug profoundly depress the heart, which is finally arrested in diastole.

Nervous System.—Antimony and potassium tartrate in small doses and under certain conditions exerts a sedative influence upon the brain. Indeed, its action is that of a depressant to the entire nervous system, particularly the spinal cord, small doses depressing the sensory side, while poisonous doses paralyze both the motor and sensory centers of the cord.

Under the administration of antimony, therefore, reflex excitability is diminished and the muscular system is depressed, the drug acting as an antispasmodic, probably by its influence both upon the muscles and the nervous system.

Respiratory System.—Very small doses have no effect upon the respiratory movements, but increase the secretions from the bronchial mucous membrane. Full doses depress the respiratory movements, shortening the inspiration, but prolonging expiration. Toxic doses render the breathing extremely irregular and greatly lengthen the pause between inspiration and expiration, while there is an enormous increase in the bronchial secretion.

The action of tartar emetic upon the respiratory system is very complex. The explanation as given by Hare is: "Primarily the respiratory center in the medulla is depressed, and the governing nerves of breathing, the pneumogastrics, are also rendered inactive; secondarily, the cardiac failure readily causes pulmonary congestion; and, thirdly, the drug causes such an outpouring of liquid and mucus into the bronchial tubes that the patient is drowned in his own secretion, which he is too weak to expel."

Absorption and Elimination.—Tartar emetic rapidly enters the blood, and is eliminated by many channels, principally by the bowels, but also by the bile, milk, sweat, and urine. The drug is an active diaphoretic, expectorant, and cholagogue.

Temperature.—Small doses do not affect temperature perceptibly; large doses lower bodily heat, chiefly by depressing the

circulation, although the drug may possibly influence the heat-center to some extent, lessening heat-production.

Untoward Action.—The untoward manifestations produced by medicinal amounts of tartar emetic in individuals having a marked susceptibility to the drug do not differ essentially from the symptoms of poisoning next described.

Poisoning.—Tartar emetic produces all the symptoms of an irritant poison—severe burning sensation in the esophagus and stomach and violent and repeated vomiting, the ejecta, in addition to undigested food, containing mucus, bile, and frequently blood.

These symptoms are attended with severe colicky pains in the abdomen and serous purging, the discharges resembling those of cholera, the analogy with the latter disease being rendered the more striking by the presence of cramps in the extremities—a characteristic feature of poisoning by tartar emetic.

Together with these gastro-intestinal symptoms there is extreme prostration, accompanied by an irregular, weak, almost imperceptible pulse, great muscular relaxation, depressed respiration, pinched and livid countenance, cold, clammy skin, reduction of temperature, and scanty and bloody urine. Death may be preceded by stupor, wild delirium, or convulsions.

Treatment of Poisoning.—If the poison has not been entirely ejected in the act of vomiting, the stomach should be immediately washed out with a solution of tannic acid, after which strong coffee should be administered, together with demulcent drinks, anodynes, and respiratory and cardiac stimulants should they be necessary.

Therapeutics.—*Externally and Locally.*—TARTAR EMETIC was formerly used as a rubefacient, being still so employed to some extent. The tendency of the drug, however, to produce extensive papular eruption and destruction of tissue renders its external use unsafe. Hebra considers that the external use of tartar emetic is a "useless, injurious procedure, and occasionally even dangerous to life."

S. Hartwell Chapman has recommended the use of a lozenge containing $\frac{1}{200}$ grain (0.0003 Gm.) of tartar emetic and $\frac{1}{60}$ grain (0.001 Gm.) of codeine in *acute inflammation of the throat* when accompanied with fever.

Internally.—The medical uses of tartar emetic are constantly becoming more restricted. Because of its slow and depressing action the employment of the drug as an emetic has been practically abandoned. It is still used as a sedative antiphlogistic in

various *acute inflammations.* It is beneficial in the early stages of *acute laryngitis* and *bronchitis*, but its administration should be discontinued after a free secretion of bronchial mucus is established.

The remedy is occasionally given for its diaphoretic influence in various *fevers*, and has even been recommended as a cholagogue.

The COMPOUND SYRUP OF SQUILLS is a useful expectorant, being a popular and efficient remedy for *croup.*

Administration.—As an emetic the action of the drug is facilitated and enhanced by associating it with ipecacuanha, the remedies together being given in powdered form.

As a diaphoretic and expectorant small doses of the wine of antimony are preferable, repeated every two or three hours.

Ipecacuănha—Ipecacuănhæ—Ipecac. *U. S. P.*

Origin.—The root of *Cephaëlis Ipecacuanha* (Brotero) A. Richard, a plant indigenous in the damp forests of Brazil, New Granada, and the northeastern portion of Bolivia. It is cultivated to some extent in India and Sikkim.

According to the National Dispensatory, "The drug first became known in Europe in 1672, and a few years after was successfully employed by Helvetius, a Dutch physician living in Paris, from whom (1688) Louis XIV. purchased the secret for 1000 louis d'or and made it public."

Description and Properties.—The older roots are in pieces of 2 to 6 inches (5–15 Cm.) in length and about $\frac{1}{6}$ inch (4 Mm.) thick, mostly simple, contorted, dull grayish-brown or blackish, finely wrinkled, closely and irregularly annulated and often transversely fissured; bark thick, brittle, brownish, easily separated from the thin, whitish, tough, ligneous portion; odor slight, peculiar, nauseous; taste bitterish, acrid, nauseating. When ipecac is sound and free from mouldiness its quality is proportionate to the thickness of the bark and the thinness of the ligneous portion.

The active principles of ipecac are *emetine* and cephaelin, of the former of which there is present 1 to 2 per cent. The drug also contains ipecacuanhic or cephaelic acid, starch, resin, etc.

Dose.—As an emetic, 15–30 grains (1.0–2.0 Gm.); as an expectorant, $\frac{1}{2}$–2 grains (0.03–0.12 Gm.).

Official Preparations.

Extrăctum Ipecacuănhæ Flūidum—Extrăcti Ipecacuănhæ Flūidi—Fluid Extract of Ipecacuanha.—*Dose*, as an emetic, 15–30 minims (0.2–0.5 Cc.); as an expectorant, $\frac{1}{2}$–2 minims (0.03–0.12 Cc.).

Pŭlvis Ipecacuănhæ et Ōpii—Pŭlveris Ipecacuănhæ et Ōpii—Powder of Ipecac and Opium. (See Opium, p. 428.)

Sўrupus Ipecacuănhæ—Sўrupi Ipecacuănhæ—Syrup of Ipecac.—Formula: Fluid Extract of Ipecac, 75; Acetic Acid, 10; Glycerin, 100; Sugar, 700; Water, to 1000.—*Dose*, as an emetic, 2–6 fluidrachms (7.39–22.50 Cc.); as an expectorant, 5–30 minims (0.3–2.0 Cc.).

Tinctūra Ipecacuănhæ et Ōpii—Tinctūræ Ipecacuănhæ et Ōpii—Tincture of Ipecac and Opium. (See Opium, p. 428.)

Trochĭsci Ipecacuănhæ—Trochĭscos (acc.) **Ipecacuănhæ—Troches of Ipecac.**—Composition: Each troche contains about ½ grain (0.02 Gm.) of Ipecac, together with Tragacanth, Sugar, and Oil of Orange.

Dose.—1 to 6 troches.

Trochĭsci Morphīnæ et Ipecacuănhæ—Trochĭscos (acc.) **Morphīnæ et Ipecacuănhæ.** (See Morphine, p. 429.)

Vīnum Ipecacuănhæ—Vīni Ipecacuănhæ—Wine of Ipecac (10 per cent.).—*Dose*, 1–60 minims (0.06–4.0 Cc.).

Antagonists and Incompatibles.—The gastric sedatives and narcotics generally hinder the emetic properties of ipecac. The incompatibles are tannic acid and vegetable infusions containing it, metallic salts, and caustic alkalies.

Synergists.—The emetics, sedative expectorants, warm drinks, are synergistic, and opium aids the diaphoretic properties of the drug.

Physiological Action.—*Externally and Locally.*—Ipecac is a powerful irritant to the mucous membranes of the respiratory tract when the powdered drug is inhaled. The prolonged application of ipecac to the skin occasions much irritation, even producing vesication, pustulation, and ulceration. Ipecac also possesses some antiseptic properties.

Internally.—Digestive System.—In small doses ipecac acts as a stimulant to the stomach. The salivary and gastric glands are stimulated, the action of very small doses of the drug resembling that of vegetable bitters.

Large doses are powerfully irritant and emetic, the emesis being the result of both a local irritation upon the stomach and a direct action upon the vomiting center in the medulla. The vomiting is preceded by and attended with but little if any nausea, although there is usually a marked increase in the secretion of bile and intestinal mucus, full doses of the drug acting not only as an emetic, but as a purgative and cholagogue.

Circulatory System.—Except in occasioning the ordinary depression incident to the act of vomiting, ipecac in moderate amounts has no influence upon the heart. Enormous doses, however, par-

ticularly if injected into the jugular vein, have destroyed the life of dogs by cardiac paralysis.

Nervous System.—Save in stimulating that portion of the medulla oblongata which presides over the act of vomiting, and a slight diminution of the reflex activity of the spinal cord, ipecac has no important action upon the nervous system.

Respiratory System.—So far as the respiratory movements are concerned, they are unaffected by moderate doses of ipecac. The bronchial mucous membrane is stimulated, augmenting the secretion of bronchial mucus, and therefore reflexly stimulating coughing.

Absorption and Elimination.—The active principle of ipecac is rapidly absorbed, being eliminated chiefly by the gastro-intestinal mucous membrane, although the other secretions share in the excretory process, the skin being especially affected by this drug, which acts as a mild diaphoretic.

Temperature.—Under medicinal doses the temperature is unchanged. Poisonous doses reduce temperature.

Untoward Action.—Rarely, in persons peculiarly susceptible to the drug, intense cutaneous irritation and conjunctival inflammation, accompanied by neuralgia of the face and scalp, have been produced. Even soiling the hand with a few drops of the tincture of ipecac has occasioned unfavorable results. The general untoward symptoms are those of poisoning.

Poisoning.—There is violent vomiting and purging, the ejecta containing bile and frequently blood. Among the graver symptoms are abdominal pain, marked cardiac depression, muscular weakness, and greatly diminished reflex irritability. The skin is cold and bathed in perspiration.

Treatment of Poisoning.—Tannic acid should be given as the chemical antidote. Opium, belladonna, and cardiac stimulants may be necessary.

Therapeutics.—*Externally and Locally.*—TROCHES OF IPECAC and spray inhalations of WINE OF IPECAC are used to allay the cough and expectoration in acute *bronchitis* and obstinate "*winter cough.*"

POWDERED IPECAC has been successfully employed as a dressing in *anthrax*, the drug being capable of destroying the anthrax bacilli, although having no effect on the spores.

Internally.—IPECAC in proper doses is a very efficient emetic, and is frequently employed as such, particularly when it is desirable through the act of vomiting to empty the air-passages, as in

croup, bronchitis, tracheitis, and the early stages of *diphtheria.* The action of the drug is so tardy, however, that it is not the most desirable emetic to use when it is necessary to empty the stomach quickly, as in cases of poisoning.

When the stomach contains a quantity of undigested food, causing pain, headache, etc., ipecac is a valuable emetic to empty the stomach, since the drug occasions no marked nausea or depression.

Paradoxical as it may seem, minute doses of IPECAC, such as 1 to 4 minims (0.06–0.2 Cc.) of the WINE or $\frac{1}{10}$ to $\frac{1}{4}$ grain (0.006–0.01 Gm.) of the POWDERED DRUG, act as an efficient gastric sedative and stomachic, frequently arresting *vomiting* when other drugs have failed. The statement, however, that minim doses of the wine of ipecac allay the nausea and vomiting of pregnancy is probably apocryphal.

IPECAC in small doses is an excellent adjuvant to other cholagogues to relieve the distress of *hepatic dyspepsia.* The drug is equally advantageous in *atonic dyspepsia,* attended with flatulence, depression of spirits, etc.

The notoriety and pecuniary profit which Helvetius secured in connection with ipecac—or *Radix antidysenterica,* as it was originally named by its propagator—were due to its apparent specific action in *dysentery.*

The drug is peculiarly efficient in dysentery of a bilious type, acute dysentery other than bilious yielding less readily to the remedy. It is true that in these last-named cases ipecac and opium have been advantageously employed, though it is probable that the opium had the larger influence in modifying the course of the disease. Whatever the form of dysenteric attack may be, ipecac is the more efficient the earlier it is administered.

The drug, in order to exert any beneficial influence in bilious dysentery, must be given in large doses—60 to 90 grains (3.88–5.83 Gm.) in a single dose or 20 grains (1.29 Gm.) every four hours. These doses of course will at first produce emesis, but the repetition of them tends to establish a tolerance of the remedy, an early attainment of which is most desirable.

Various methods have been employed to aid the stomach in retaining the drug, such as the administration of opium or other gastric sedative, a sinapism placed upon the epigastrium, etc.

Ipecac has been highly recommended in *infantile diarrhea.* It has been successfully employed in *hematemesis* and *uterine hemor-*

rhage, it being customary in the former complaint to give at first an emetic dose, succeeded by smaller and nauseating amounts.

Like other emetics, ipecac has proved efficient in expediting labor by relieving *rigidity of the os uteri*.

The drug has been found beneficial in relieving *hemoptysis*, and it is of unquestioned value in many affections of the lungs and bronchial tubes. In *pneumonia*, particularly in the congestive and declining stages of the disease, it has proved serviceable.

In *bronchitis* and *phthisis*, especially when the secretion is scanty, and in *chronic bronchitis* with much cough and but a moderate amount of expectoration, ipecac is a valuable remedy. It has been found valuable in *spasmodic asthma*.

Ipecac is an important adjuvant to quinine in the treatment of *remittent* and *intermittent fevers*, the latter disease having been cured, it is claimed, by ipecac alone in doses of 1 or 2 grains (0.06–0.12 Gm.), given every three or four hours.

Contraindications.—Ipecac is not permissible for patients suffering from aneurysm, hernia, prolapse of uterus or rectum, etc.

Administration.—The drug is notoriously uncertain in its action, probably because of the variation in the percentage of emetine, the freshly powdered root being ordinarily more reliable.

For purposes of emesis the freshly powdered root is preferable, to be taken with plenty of warm water. An infusion or decoction is frequently employed to produce emesis.

As a diaphoretic the powder is also preferable, though in any case the fluid extract may be substituted for the powdered form. As an expectorant the syrup and wine are the preparations usually employed.

Children are very tolerant of ipecac, the syrup being the preparation usually given to them.

Emetine, though not official, is an important remedy, and may be administered as an emetic in doses of $\frac{1}{12}$ to $\frac{1}{6}$ grain (0.005–0.01 Gm.), and in correspondingly small doses when a diaphoretic or expectorant action is desired.

Lobēlia—Lobēliæ—Lobelia. *U. S. P.*

(Indian Tobacco.)

Origin.—The leaves and tops of *Lobelia inflata* L., collected after a portion of the capsules have become inflated. The plant is indigenous in the United States.

Description and Properties.—As it appears in the market

lobelia consists of fragments of green leaves, stems, rather elongated dried flowers, and portions of the membranous capsules. The odor is very irritating, and the taste pungent and persistently acrid. The plant contains a yellowish acrid liquid alkaloid, *lobeline*, besides *lobelic acid*, *lobelacrin*, resin, fixed oil, gum, etc.

Dose.—1–10 grains (0.065–0.6 Gm.).

Official Preparations.

Extractum Lobeliæ Fluidum—Extracti Lobeliæ Fluidi—Fluid Extract of Lobelia.—*Dose*, 1–10 minims (0.06–0.6 Cc.).

Tinctura Lobeliæ—Tinctūræ Lobeliæ—Tincture of Lobelia (20 per cent.). —*Dose*, 8–15 minims (0.5–1.0 Cc.).

Antagonists and Incompatibles.—The effects of lobelia on the circulatory system are antagonized by the cardiac stimulants; its influence on the nervous system is counteracted by strychnine and other motor excitants. The incompatibles are all caustic alkalies.

Synergists.—The motor depressants and emetics enhance the effects of lobelia.

Physiological Action.—*Externally and Locally.*—Although the drug is readily absorbed through the skin, there is no action of importance.

Internally.—Digestive System.—Lobelia produces symptoms similar to those of ipecac, save that lobelia is more powerful, occasioning more distressing nausea and intense prostration.

Circulatory System.—Lobelia is a powerful cardiac depressant, its action being due both to direct depression of the heart and paralysis of the vaso-motor centers. Under poisonous doses the heart stops in diastole.

Nervous System.—Full doses depress the motor nerve-ganglia. Poisonous doses are necessary to affect the higher cerebral centers, when coma and convulsions are produced. The muscles and nerves themselves are unaffected by lobelia.

Respiratory System.—The muscular coats of the bronchi are relaxed by the drug. The respiration is slowed even by small doses. Large or toxic doses profoundly depress the respiratory center, death resulting from respiratory failure.

Absorption and Elimination.—The active principle of lobelia is readily absorbed, and is excreted chiefly by the kidneys and skin, the drug acting as a diuretic and diaphoretic. Under emetic doses much of the drug is eliminated by way of the stomach and intestines.

Temperature.—Full doses lower the temperature.

Untoward Action.—Does not differ essentially from the effects of poisoning.

Poisoning.—The symptoms include—violent vomiting and purging, a very weak and irregular pulse, an anxious, livid countenance, skin cold and bathed in perspiration, respiration slow and very feeble, contracted pupils, and possibly coma or convulsions preceding death, which occurs from respiratory failure.

Treatment of Poisoning.—The symptoms should be counteracted by cardiac and respiratory stimulants, employing such drugs as atropine, strychnine, alcohol, ammonia, etc., hypodermically.

Therapeutics.—*Externally and Locally.*—None.

Internally.—While formerly lobelia was used extensively as an emetic, at the present day, owing to the intense nausea and great depression occasioned by the drug, it has been practically supplanted by other less dangerous emetics.

Its principal use nowadays is as a remedy in *spasmodic asthma* and as an expectorant in certain cases of *bronchitis.*

Contraindications.—The same as for emetics in general.

Administration.—The powder, fluid extract, or tincture may be used. The taste of the fluid preparations may be agreeably disguised by aromatic elixir or aromatic elixir of liquorice.

GROUP XII.—EXPECTORANTS.

EXPECTORANTS are drugs which stimulate, depress, or modify the secretion from the bronchial or laryngeal membrane and promote its expulsion.

There are many drugs not classed as expectorants which, under certain conditions, may be used to serve one of these purposes. Thus, opium and chloral, by the depressing influence which they exert upon the respiratory center and the reflex mechanism, may relieve reflex and purposeless cough, or, as is the case with the former drug, check excessive secretion or render it more viscid.

Demulcents, such as gum acacia, flaxseed, elm, etc., and other drugs like potassium chlorate, sodium chloride, etc., either lessen or excite the tracheal and bronchial cilia, retarding or promoting expectoration of bronchial mucus. The classification usually adopted seems to be the most reasonable—viz. that of dividing expectorants into two classes: 1. Nauseant or Sedative. 2. Stimulating.

Among the more important Nauseant or Sedative Expectorants are—

* Alkalies;
* Antimony and Potassium Tartrate (Tartar Emetic);
* Apomorphine;
* Grindelia;
* Ipecacuanha;
* Lobelia;
* Pilocarpus;
* Potassium Iodide;
* Quebracho;

all of which are considered in detail elsewhere.

The important Stimulating Expectorants are—

* Acids;
* Ammonium Carbonate;
Ammonium Chloride;
* Balsam of Peru;
Balsam of Tolu;
* Benzoin and Benzoic Acid;
* Copaiba;
* Cubeb;
Garlic;
Liquorice;
* Nux Vomica (Strychnine);
Oil of Scotch Fir (Oleum Pini Sylvestris);
Oleum Pini Pumilionis;
Onion;
Saccharine Substances;
Senega (Saponin);
* Sulphur;
* Squill;
Tar;
Terebene;
Terpin Hydrate;
* Turpentine.

(Those marked with an asterisk (*) are elsewhere given in detail.)

As a rule, Sedative Expectorants are permissible only in acute stages of bronchitis, when, as is the case in the beginning of all catarrhal inflammations, there is complete or partial suspension of function, absence of secretion, and much irritation in the bronchi, with distressing, harsh, and dry cough.

In these conditions of the respiratory passages the nauseating sedative expectorants serve a useful purpose in lowering arterial tension, lessening the blood-supply to the inflamed parts, and increasing the secretion of mucus.

In sufficiently large doses to produce emesis the same expectorants are frequently employed to expel an accumulation of mucus mechanically by the act of vomiting.

Stimulating expectorants are more serviceable in chronic and relaxed conditions of the mucous membrane. They are usually employed to diminish or disinfect an abnormally increased secretion. These remedies generally increase blood-pressure and facilitate expectoration, being eliminated to a great extent by the mucous membranes which they stimulate.

The alkalies are especially useful in lessening the viscidity of mucus, rendering it more fluid, less tenacious, and therefore more easily expelled.

It requires considerable skill to combine expectorants so as to best suit the various conditions found in practice. The diseases of the respiratory passages gradually merge, so that in the treatment of them it is often difficult to decide which remedy will be of more service, a sedative or a stimulant expectorant. The physician should carefully examine each individual case and decide whether he wishes to diminish or increase the blood-supply to the respiratory tract; to stimulate or depress the respirations; to overcome spasm of the bronchial muscles; to diminish, increase, or disinfect the bronchial secretion.

A thorough knowledge of the patient's condition and of the physiological action of the various remedies at command will enable the observant practitioner to combine expectorants in such manner as to yield ordinarily highly satisfactory results.

Ammōnii Chlōridum—Ammōnii Chlōridi—Ammonium Chloride. *U. S. P.*

Origin.—Ammonium sulphate is first formed by neutralizing Gas Liquor with Sulphuric Acid. After crystallization sublime with Sodium Chloride.

Description and Properties.—A white, crystalline powder, without odor, having a cooling, saline taste, and permanent in the air. Soluble in 3 parts of water; almost insoluble in alcohol.

Dose.—1–30 grains (0.06–2.0 Gm.).

Official Preparation.

Trochĭsci Ammōnii Chlōridi—Trochĭscos (acc.) **Ammōnii Chlōridi—Troches of Ammonium Chloride.**—Each troche contains 2 grains (0.12 Gm.).—*Dose*, 1 to 6 troches.

Antagonists and Incompatibles.—Therapeutically, ammonium chloride is antagonized by the cardiac depressants. The incompatibles are—alkalies, alkaline earths and their carbonates, tartaric acid, mineral acids, and the soluble lead and silver salts.

Synergists.—The expectorants, emetics, and diaphoretics enhance the action of the drug.

Physiological Action.—*Externally and Locally.*—Ammonium chloride is irritant and resolvent.

Internally.—In medicinal doses the drug increases the secretions from the gastro-intestinal glands, acting as a cholagogue. The solid constituents of the blood are diminished. The drug appears to have a special action upon the mucous membranes, augmenting their normal secretions and promoting nutritive changes and epithelial exfoliation.

Ammonium chloride is readily absorbed, and is eliminated by the kidneys, skin, bronchi, and mucous membranes generally, the drug being a feeble diuretic, diaphoretic, and expectorant.

Save uric acid, which is slightly diminished, all the solids of the urine are increased under the use of ammonium chloride. The drug is not considered poisonous.

Therapeutics.—*Externally and Locally.*—AMMONIUM CHLORIDE possesses a wide range of therapeutic applications. Solutions of various strengths have proved markedly efficient as local applications in *indolent buboes*, *epididymitis*, *orchitis*, *bruises*, *inflammatory swellings*, *suppurative mastitis*, etc. *Senile gangrene* is much benefited by immersing the foot in a bath containing 8 ounces (249.0 Gm.) of the drug.

A solution of 3 drachms (12.0 Gm.) of ammonium chloride to 1 pint (473.17 Cc.) of water is an efficient remedy in *vaginitis*. The lotion may be used as an injection or a tampon saturated with the fluid and applied to the parts.

LOZENGES, SOLUTIONS, or the NASCENT FUMES of the drug have been found serviceable in many diseases of the *nose*, *throat*, and *ear*, such as *coryza*, *chronic laryngitis* and *pharyngitis*, *chronic aural catarrh*, etc.

Internally.—Few remedies are more efficient than AMMONIUM CHLORIDE in *bronchitis* that has passed its inflammatory stage. In *chronic bronchitis*, particularly that form occurring in old people and persons of a feeble habit of body, the drug is very valuable, either given alone or associated with stimulant expectorants. The remedy has appeared to be somewhat beneficial in *whooping cough*.

AMMONIUM CHLORIDE has been employed in *intermittent fever* and to promote the eruption in the *exanthematous fevers*. It is certainly of great utility in *goiter*, and has proved beneficial in *amenorrhea* and *dysmenorrhea*. The drug is considered an efficient remedy in *glandular enlargements*, as in those of the *prostate*, *liver*, etc. It assuredly stimulates the functional activity of the liver and is frequently given as a cholagogue.

Ammonium chloride usually exerts a prompt and salutary

action in *neuralgias*, particularly the neuralgia affecting the fifth pair, the intercostal nerves, and the sciatic nerve. The remedy has been also advantageously employed in *myalgia* and *chronic muscular rheumatism.*

Contraindications.—Inflammation of the stomach, aggravated dyspepsia, marked emaciation, and anemia contraindicate the drug.

Administration.—Ammonium chloride is best given in solution, its disagreeable taste being well disguised by the addition of some preparation of liquorice, such as the syrup, fluid extract, or the aromatic elixir of liquorice. In bronchial diseases the virtues of the drug are enhanced by this association.

Bălsamum Tolutānum—Bălsami Tolutāni—Balsam of Tolu. *U. S. P.*

Origin.—A balsam obtained from *Toluifera Balsamum* L., an evergreen tree from 60 to 80 feet (18–24 M.) high, growing in the high, rolling country of Venezuela and New Granada.

Description and Properties.—A yellowish-brown, semi-fluid, or nearly solid mass, becoming more brittle when exposed to cold; transparent in thin layers, having an agreeable odor, recalling that of vanilla, but distinct from it, and a mild, aromatic taste; readily and completely soluble in alcohol, chloroform, and solutions of the fixed alkalies; almost wholly soluble in ether, but nearly insoluble in water or carbon disulphide.

The drug contains a volatile oil (chiefly toluene), cinnamic and benzoic acids, and a resin.

Dose.—8–30 minims (0.5–2.0 Cc.).

Official Preparations.

Sўrupus Tolutānus—Sўrupi Tolutāni—Syrup of Tolu (1 per cent.).—*Dose*, 2–6 fluidrachms (8–24 Cc.).

Tinctūra Tolutāna—Tinctūræ Tolutānæ—Tincture of Tolu (10 per cent.).—*Dose*, ½–2 fluidrachms (2–8 Cc.).

Tinctūra Benzoīni Compŏsita—Tinctūræ Benzoīni Compŏsitæ—Compound Tincture of Benzoin (4 per cent.).—Described under *Benzoin.*

Antagonists and Incompatibles.—Aqueous preparations are pharmaceutically incompatible with the tincture of tolu.

Synergists.—The balsams, aromatic drugs, volatile oils, and stimulant expectorants.

Physiological Action.—Balsam of tolu is antiseptic, disinfectant, and stimulant when applied to the skin and to raw surfaces. It is a pleasant carminative and stomachic.

The drug is excreted principally by the mucous membranes, the secretions from which it stimulates and disinfects. The skin and kidneys also share in the excretory process.

Therapeutics.—Inhalations of the vapor of tolu have been successfully employed in the treatment of *chronic pharyngitis*, and a pigment composed of 1 part of tolu to 5 parts of ether or alcohol has been beneficially applied to *diphtheritic deposits* on the tonsils and pharynx.

Its agreeable flavor, together with its stimulating and expectorant properties, renders tolu an efficient and eligible ingredient of cough mixtures, lozenges, vapors, etc. employed to modify the course of *subacute* and *chronic bronchitis*.

Administration.—Tolu is usually administered in the form of syrup, although the tincture may be given in emulsion. Inhalations of tolu vapor are employed and lozenges containing tolu are frequently used.

Ăllium—Ăllii—Garlic. *U. S. P.*

Origin.—The bulb of *Allium sativum* L., a bulbous plant indigenous in Central Asia and the basin of the Mediterranean, and cultivated for culinary purposes in Europe and North America.

Description and Properties.—Bulb subglobular, compound, consisting of about eight compressed, wedge-shaped bulblets, arranged in a circle about the base of the stem and covered by several dry, membranaceous scales. Odor pungent and disagreeable; taste warm and acrid. Garlic should be used without having been dried.

The drug contains about $\frac{1}{4}$ per cent. of a volatile oil, to which its odor and taste are due.

Dose, of bruised or chopped garlic or of the expressed juice, about 30 grains (2.0 Gm.).

Official Preparation.

Sȳrupus Ăllii—Sȳrupi Ăllii—Syrup of Garlic.—*Dose*, 1–2 fluidrachms (4.0–8.0 Cc.).

Allied Species.

Ăllium Cēpa L.—**Ăllii Cēpæ—Onion.**

Physiological Action.—Both garlic and onion are stimulants to the part to which they are directly applied, garlic being the stronger of the two.

Internally they are carminative and stomachic, and are used as condiments and as foods. Like all substances which stimulate the digestive apparatus, in excessive amounts they may occasion nausea, vomiting, colic, and diarrhea.

The active constituents of these drugs are eliminated by the mucous membranes, skin, kidneys, and respiratory tract. The taste and odor of the drugs are imparted to the milk of nursing women. Both garlic and onion are rapidly absorbed and about as quickly eliminated.

Therapeutics.—An ONION POULTICE is a valuable domestic remedy for *chronic* or *acute bronchitis* in children, *abscesses*, and to relieve *strangury* when applied to the perineum, in which case it proves to be singularly efficient.

The core of a roasted ONION is said to quickly relieve *earache* when inserted in the auditory canal.

SYRUP OF GARLIC or ONION is an invaluable expectorant in *chronic catarrhs of the respiratory passages* in children and infants, and is quite an efficient remedy in the decline of *whooping cough*.

A synthetical substance known as **Allyl Tribromide** (Tribromhydrin), closely allied to oil of garlic, has been highly recommended in *spasmodic asthma*, *infantile convulsions*, *hysteria*, *angina pectoris*, and other spasmodic disorders. It should be administered in capsules in doses of from 1 to 5 minims (0.06–0.3 Cc.).

Administration.—When garlic or onion is used for poultices, it should be boiled.

Internally, the expressed juice made into a syrup with sugar or the official syrup of garlic is the form in which these drugs are usually given.

Glycyrrhīza—Glycyrrhīzæ—Glycyrrhiza. *U. S. P.*

(LIQUORICE ROOT.)

Origin.—The root of *Glycyrrhiza glabra* L. and of the variety *glandulifera* (Waldstein et Killaibel) Regel et Herder, a perennial plant indigenous in the countries lying on the northern and southern shores of the Mediterranean and farther east through the Caucasus, Northern Persia, Afghanistan, and Southern Siberia to China, and cultivated to some extent in England, France, Germany, and the United States.

Description and Properties.—In long, cylindrical pieces from $\frac{1}{4}$ to 1 inch (6–25 Mm.) thick, longitudinally wrinkled, externally grayish-brown, warty; internally tawny yellow, pliable, tough;

fracture coarsely fibrous; bark rather thick; wood porous, but dense in the narrow wedges; medullary rays linear; taste sweet, somewhat acrid. The underground stem, which is often present, has the same appearance, but contains a thin pith.

The drug derived from the variety *glandulifera* (so-called Russian liquorice) consists usually of roots or root-branches 1 to 4 inches (2–10 Cm.) thick and 8 to 12 inches (15–30 Cm.) long, frequently deprived of the corky layer, the wood rather soft and usually more or less cleft.

Liquorice contains a glucoside, *glycyrrhizin*, besides asparagin, glycyramarin, an acrid resin, starch, etc.

Dose.—15–60 grains (1–4 Gm.).

Official Preparations.

Extractum Glycyrrhizæ Fluidum—Extracti Glycyrrhizæ Fluidi—Fluid Extract of Glycyrrhiza.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Extractum Glycyrrhizæ—Extracti Glycyrrhizæ—Extract of Glycyrrhiza.—*Dose*, freely. (Extract of Glycyrrhiza is contained in Trochisci Ammonii Chloridi and Trochisci Glycyrrhizæ et Opii.)

Extractum Glycyrrhizæ Purum—Extracti Glycyrrhizæ Puri—Pure Extract of Glycyrrhiza.—*Dose*, freely.

Glycyrrhizinum Ammoniatum—Glycyrrhizini Ammoniati—Ammoniated Glycyrrhizin.—*Description and Properties.*—Dark-brown or brownish-red scales, without odor and having a very sweet taste; readily soluble in water and in alcohol.

Dose.—5–15 grains (0.3–1.0 Gm.).

Mistura Glycyrrhizæ Composita—Mistura Glycyrrhizæ Compositæ—Compound Mixture of Glycyrrhiza (Brown Mixture).—Formula: Pure Extract of Glycyrrhiza, 30; Sugar, 50; Mucilage of Acacia, 100; Camphorated Tincture of Opium, 120; Wine of Antimony, 60; Spirit of Nitrous Ether, 30; Water, to 1000.

Dose.—1–4 fluidrachms (4.0–15.0 Cc.).

Pulvis Glycyrrhizæ Compositus—Pulveris Glycyrrhizæ Compositi—Compound Powder of Glycyrrhiza. (See Senna, p. 681.)

Besides the foregoing compounds, glycyrrhiza forms a more or less important ingredient of eleven other official preparations.

Physiological Action and Therapeutics.—The drug when chewed increases the flow of saliva. It is demulcent and laxative, and possesses slight stimulating properties when locally applied. It favors the secretions of the congested mucous membrane of the respiratory passages.

Liquorice is used chiefly for its demulcent properties in *sore throat, hoarseness, pharyngeal cough, acute bronchitis*, etc. An infusion of the root is an agreeable and useful drink in *febrile catarrhal affections* and in *irritative disorders of the bowels* and *urinary* organs attended with fever and great thirst.

The various preparations of liquorice are serviceable in concealing the taste of nauseous and bitter medicines and as an excipient for pills.

Administration.—There are no special directions to be given—any of the preparations may be used.

Ōleum Pīni Sylvĕstris—Ōlei Pīni Sylvĕstris—Oil of Scotch Fir (unofficial).—*Origin, Description, and Properties.*—A volatile oil distilled from the leaves of *Pinus Sylvestris*, colorless, fragrant. Used by inhalation or locally. The drug is used in various sprays and inhalations in *nasal catarrh, acute coryza*, and many diseases of the respiratory passages.

Ōleum Templīnum—Ōlei Templīni—Oil of Pine (unofficial).—*Origin, Description, and Properties.*—A volatile oil distilled from the shoots of *Pinus Pumilio*. A colorless or yellowish-green oil, of an agreeable, somewhat terebinthinate odor.

Oleum Templinum is used in the same manner and for the same purposes as Oil of Scotch Fir.

Pix Līquida—Pīcis Līquidæ—Tar. *U. S. P.*

Origin.—An empyreumatic oleoresin obtained by the destructive distillation of the wood of *Pinus palustris* Miller, and other species of *Pinus*.

Description and Properties.—Thick, viscid, semi-fluid, blackish-brown, heavier than water, transparent in thin layers, becoming granular and opaque with age; odor empyreumatic, terebinthinate; taste sharp, empyreumatic. Tar is slightly soluble in water; soluble in alcohol, fixed and volatile oils, and solution of potassium or sodium hydrate.

The drug contains many substances, chief among which are an empyreumatic, volatile oil, pyrocatechin, acetone, xylol, toluol, cresols (creasote), guaiacol, phenol, etc.

Dose.—15–60 grains (1–4 Gm.).

Official Preparations.

Sўrupus Pīcis Līquidæ—Sўrupi Pīcis Līquidæ—Syrup of Tar (7.5 per cent.).—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Unguĕntum Pīcis Līquidæ—Unguĕnti Pīcis Līquidæ—Tar Ointment (50 per cent.).—Used externally.

Ōleum Pīcis Līquidæ—Ōlei Pīcis Līquidæ—Oil of Tar. U. S. P.—*Origin.*—A volatile oil distilled from tar.

Description and Properties.—An almost colorless liquid when freshly distilled, but soon acquiring a dark reddish-brown color and having a strong tarry odor and taste. It is readily soluble in alcohol.—*Dose*, 1–5 minims (0.065–0.3 Cc.).

Unofficial Preparations.

Āqua Pīcis Līquidæ—Āquæ Pīcis Līquidæ—Tar Water.—*Dose*, 1 pint (473.17 Cc.) in the course of a day.

Glycerītum Pīcis Līquidæ—Glycerīti Pīcis Līquidæ—Glycerite of Tar.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Vīnum Pīcis (N. F.)—**Vīni Pīcis—Wine of Tar** (a saturated solution in sherry wine).—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Derivatives and Allied Drugs.

Lȳsol.—Prepared by the action of alkalies on tar-oils and fats. A brownish, oily liquid with a feeble, aromatic creasote-like odor, containing 50 per cent. of cresols and readily miscible with water. Used as a disinfectant and antiseptic.

Pĭxol.—A compound of tar soap and caustic potash or soda. Used as a disinfectant and antiseptic.

Pix Bĕtulæ—Pīcis Bĕtulæ—Birch Tar (Oleum Rusci).—*Origin.*—Prepared in Russia from the wood and bark of *Betula alba* L.

Description and Properties.—Resembling wood-tar in appearance, but remaining liquid, and having the peculiar, penetrating odor of Russia leather, in the manufacture of which it is used. For the most part employed externally.

Ōleum Cadīnum—Ōlei Cadīni—Oil of Cade. U. S. P.—*Origin.*—A product of the dry distillation of the wood of *Juniperus oxycedrus* L.

Description and Properties.—An empyreumatic, brownish or dark-brown, clear, thick liquid, possessing a tarry odor and an empyreumatic, burning, somewhat bitter taste. Almost insoluble in water; partially soluble in alcohol.

Dose.—2–6 minims (0.12–0.3 Cc.). Chiefly used externally.

Antagonists and Incompatibles.—There are none of special importance.

Synergists.—The aromatics, carbolic acid, creasote, and many of the antiseptics, turpentine, and the stimulant expectorants.

Physiological Action.—*Externally and Locally.*—Tar is a stimulant, astringent, antipruritic, antiseptic, and parasiticide. It is readily absorbed from the skin, and when applied too freely may produce a papular eruption.

Internally.—The action of tar closely resembles that of turpentine, although creasote is perhaps a more perfect analogue. Small doses stimulate the circulation and increase secretions generally. Immoderate dosage or the prolonged administration of tar impairs the appetite, deranges digestion, and depresses the circulatory and nervous systems.

While the drug is not considered poisonous, the ingestion of excessive quantities of oil of tar has been attended with fatal results. The symptoms following imprudent dosage are nausea, vomiting, severe abdominal pain, diarrhea, headache, and dizziness. The urine is colored blackish-brown, and may contain blood or albumin and emit the peculiar odor of tar. There may be present erythema, or the skin may be covered with papules or vesicles attended with intense itching.

Therapeutics.—*Externally and Locally.*—With the possible

exception of sulphur and mercury, TAR is the most universally employed remedy for cutaneous diseases, the drug having for centuries held an important place among the efficient topical agents in the treatment of *diseases of the skin, unhealthy ulcers, fissured nipples, boils, excoriations,* etc.

In *chronic eczema* the drug is peculiarly serviceable, and it has proved beneficial in *chronic psoriasis* and *scabies.*

The OIL OF CADE and OIL OF BIRCH are used for the same purposes as tar, being usually preferred by expert dermatologists. The tarry preparations are valuable antipruritics, and of service in *pruritus* and various itching diseases of the skin, although their tendency to produce irritative and inflammatory effects when continuously and injudiciously applied should not be overlooked.

The benign and emollient effects of TAR are best obtained when the drug is mixed with some soothing or astringent powder, such as chalk.

The valuable properties of tar in the treatment of cutaneous diseases are often nullified by the ignorance of the physician and lack of proper administration of the drug. Prof. James Nevins Hyde has truthfully observed that "the skill of a physician entrusted with the management of a disease of the skin might also be measured by his success in the use of tar."

LOZENGES containing tar, the VAPOR OF OIL OF TAR, and sprays containing tar are extensively employed in the treatment of various *diseases of the nose and throat.*

Internally.—TAR has long possessed an enviable reputation as a remedy for chronic pulmonary complaints, being very efficient in the treatment of *chronic bronchitis* and the advanced stages of obstinate *acute bronchitis,* lessening the expectoration, allaying the oppression and distress in the chest, and soothing the cough. These symptoms, which attend many cases of *pulmonary phthisis,* are frequently relieved by some preparation of tar.

Not only is this remedy of value in catarrhal conditions of the respiratory passages: it is equally efficient in similar conditions of mucous membranes elsewhere. Thus TAR WATER has been employed with great benefit in *gleet, leucorrhea, vesical catarrh,* etc., being given both by the mouth and in the form of an injection.

Administration.—Tar may be given in milk or beer or in pill form, although the most palatable forms are the syrup, glycerite, wine, and tar water, the last of which may be given to the extent of 1 or 2 pints (473.17 or 946.35 Cc.) daily.

Sĕnega—Sĕnegæ—Senega. *U. S. P.*

Origin.—The root of *Polygala Senega* L., a plant indigenous in North America, from Canada southward to South Carolina and westward to Wisconsin.

Description and Properties.—About 4 inches (10 Cm.) long, with a knotty crown and spreading, tortuous branches, keeled when dry, fleshy and round after having been soaked in water; externally yellowish-gray or brownish-yellow; bark thick, white within, enclosing an irregular, porous, yellowish wood; odor slight, unpleasant; taste sweetish, afterward acrid. Senega contains *senegin*, also known as saponin, and polygalic acid, an acrid principle to which the medicinal property of the drug is due, besides a fixed and a volatile oil.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Extrăctum Sĕnegæ Flŭidum—Extrăcti Sĕnegæ Flŭidi—Fluid Extract of Senega.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Sўrupus Sĕnegæ—Sўrupi Sĕnegæ—Syrup of Senega (20 per cent. of fluid extract).—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Sўrupus Scĭllæ Compŏsitus—Sўrupi Scĭllæ Compŏsiti—Compound Syrup of Squill (contains 8 per cent. of Senega). (Described under *Scilla*, p. 635.)

Physiological Action.—*Externally and Locally.*—The active principle of senega is a decided irritant to the skin and mucous membranes, causing violent sneezing and cough, with marked hydremia and increased secretion from the bronchial and nasal mucous membranes when the powder is inhaled.

Internally.—Digestive System.—Small doses stimulate the mucous membranes of the mouth and stomach, augmenting the salivary and gastric secretions, although frequently occasioning indigestion. Large doses irritate the alimentary canal, producing vomiting, diarrhea, and abdominal pain.

Circulatory System.—The active principle of senega circulates in the blood unchanged, affecting the heart and blood-vessels after the manner of digitalis, though with less power and certainty.

Nervous System.—Under medicinal doses no important action has been noted. Very large doses depress the nervous system.

Respiratory System.—It is here that senega appears to exert its most important influence. The excretion of the drug through the bronchial mucous membrane irritates the respiratory passages, occasioning hyperemia, increased secretion, and, reflexly, cough.

Absorption and Elimination.—The active principle of senega is

absorbed with difficulty, being excreted through the bronchial mucous membrane and the kidneys, irritating these structures during the process, and consequently acting as a stimulant, expectorant, and diuretic. The drug also possesses some diaphoretic virtue, being partially excreted by the skin.

Temperature.—The body-heat is uninfluenced.

Uterus.—It is believed that senega possesses emmenagogue properties.

Untoward Action.—Immoderate, and in certain susceptible subjects small, doses of senega have produced irritation and burning in the throat, salivation, impaired appetite, a sense of oppression in the stomach, nausea, vomiting, colicky pains, and profuse diarrhea.

Poisoning.—Senega is not regarded as a poisonous drug, excessive doses producing symptoms analogous to those of "Untoward Action," save that they are intensified.

Treatment of Poisoning.—Elimination is to be favored, and the symptoms treated as they appear, gastric sedatives, anodynes, and cardiac stimulants being employed.

Therapeutics.—*Externally and Locally.*—No action has been observed.

Internally.—The principal use of SENEGA is that of a stimulating expectorant. The reputation of the drug originated with its efficacy in *typhoid pneumonia*, and it is still considered a valuable remedy in asthenic pulmonary diseases.

It is highly beneficial in *subacute bronchitis* when the power to cough is feeble. In like manner senega is useful in *bronchorrhea* and *chronic bronchitis* with profuse expectoration, though less valuable when the mucus is tough and scanty.

The simple *catarrhal laryngitis* following *croup* is greatly relieved by the administration of senega.

The drug is an appropriate remedy in *amenorrhea* the result of passive uterine congestion, and SENEGIN has been recommended as a remedy for *uterine hemorrhage.*

According to some authorities, the drug has proved beneficial in *chronic rheumatism.*

Contraindications.—Senega is inadmissible in acute bronchitis and indigestion, or when there is marked irritation and inflammation of the gastro-intestinal tract.

Administration.—The syrup of senega is the preparation usually employed as an expectorant. Senegin may be given in doses of 2 grains (0.13 Gm.) in capsules.

Terebēnum—Terebēni—Terebene. *U. S. P.*

Origin.—A liquid consisting chiefly of Pinene, and containing only very small proportions of Terpinene and Dipentene; obtained by the action of Sulphuric Acid upon Turpentine, and distillation.

Description and Properties.—A colorless or slightly yellowish, thin liquid having rather an agreeable thyme-like odor and an aromatic, somewhat terebinthinate taste. Only slightly soluble in water, but soluble in an equal volume of alcohol. Terebene should be kept in well-stoppered bottles, in a cool place protected from light.

Dose.—5–15 minims (0.3–1.0 Cc.).

Physiological Action.—When applied externally terebene acts as a stimulant, germicide, antiseptic, and astringent. Internally, small doses act as a stimulant to the gastro-intestinal tract, large amounts being irritant and producing effects similar to those of turpentine.

The drug is eliminated by the kidneys, bronchial mucous membranes, skin, bowels, etc., acting as a mild astringent and antiseptic at the points of elimination.

Therapeutics.—*Externally and Locally.*—The inhalation of terebene—20 minims (1.23 Cc.) daily—allays the cough of *laryngeal phthisis* and has proved beneficial in irritative *bronchial cough*, while a spray of terebene mixed with oil of eucalyptus and alcohol has been advised in *whooping cough.*

Equal parts of terebene and olive oil have been recommended by Vaucher and Bertin in the treatment of *uterine cancer.* Terebene has been successfully employed as a general antiseptic dressing of *wounds*, *ulcers*, *burns*, etc.

Internally.—Whether inhaled or taken into the stomach, terebene is a powerful stimulant, antiseptic expectorant in *chronic bronchitis.*

The drug is of service in affections of either the upper or lower respiratory passages. In *winter cough*, *bronchorrhea*, *emphysema*, and even in *phthisis*, it is an efficient remedy.

Not only in bronchial affections is the drug valuable, but it has been used with striking success as a substitute for copaiba and oil of sandalwood in *genito-urinary diseases.* It has even been claimed to influence favorably the course of *puerperal fever* and to relieve the symptoms of *flatulent dyspepsia.*

Administration.—Terebene may be given in emulsion or in mixtures associated with other expectorants and enclosed in capsules or dropped upon sugar.

Terpīni Hȳdras—Terpīni Hydrātis—Terpin Hydrate. *U. S. P.*

Origin.—The hydrate of the diatomic alcohol Terpin, prepared by mixing rectified Oil of Turpentine, Alcohol, and Nitric Acid, allowing the mixture to stand for three or four days in shallow porcelain dishes, collecting the crystals which have formed, drying on absorbent paper, and recrystallizing in a cold solution of alcohol.

Description and Properties.—Colorless, lustrous, rhombic prisms, nearly odorless, and having a slightly aromatic and somewhat bitter taste. Permanent in the air. Soluble in about 250 parts of water and in 10 parts of alcohol. Terpin hydrate should be kept in well-stoppered bottles.

Dose.—2–30 grains (0.12–2.0 Gm.).

Physiological Action.—Terpin hydrate is a powerful antiseptic, its action resembling that of turpentine, though inferior in strength.

Therapeutics.—*Externally and Locally.*—The drug is used in the form of lozenges and as an inhalant in *chronic tracheitis* and *chronic bronchitis.*

Internally.—Terpin hydrate may be used for the same purposes as terebene, being considered by some physicians superior to the latter drug in bronchial affections. It has been recommended as an efficient remedy in *asthma, hay fever, nephritis,* and *neuralgia.*

Administration.—Terpin hydrate may be given in lozenges, emulsion, or aromatic elixir, although the most judicious method of administration perhaps is in capsules.

Terpinol is obtained by boiling terpin hydrate with dilute mineral acids. It occurs as an oily body with a hyacinthine odor. Insoluble in water, but readily soluble in alcohol and in ether.

Terpinol is a valuable bronchial stimulant, and may be used for the same diseases of the respiratory passages for which terpin hydrate is recommended.

It is best given in capsules, in doses of about 2 grains (0.12 Gm.) each, repeated from four to six times a day.

GROUP XIII.—DIURETICS

AND SUBSTANCES ACTING ON THE KIDNEYS AND THE URINARY SYSTEM.

DIURETICS are drugs which increase the flow of urine. Considered in a broader sense, however, these agents augment the secretion and modify the character of the urine—

1. By increasing the amount.

2. By rendering the urine acid.

3. By rendering the urine alkaline.

4. By removing waste products or increasing the solid constituents of the urine.

5. By preventing the decomposition of the urine.

The last-named action is peculiar to benzoic * and salicylic * acids, cubeb, copaiba, uva-ursi, oil of sandalwood, volatile oils,* saccharin, and salol.[1]

The following medicines affecting the urinary system are called *Lithontriptics*, because of their power to prevent the formation of concretions in the urinary passages or to dissolve them when formed:

Piperazin, potassium salts,* lithium salts,* ammonium benzoate,* benzoic acid,* dilute nitric acid.*

Among the principal drugs which render the urine *acid* are—benzoic * and salicylic * acids and many of their salts, immoderate amounts of the vegetable acids,* and sour wines.*

The alkalies,* particularly the potassium and lithium salts, when taken internally, render the urine *alkaline* in reaction.

Diuretics may be either Direct or Indirect—*i. e.* they may act on the kidneys themselves or upon certain structures outside the kidneys. The structures in the kidneys which have to do with the elimination of water, solids, etc. are—1. The *Malpighian tufts*, which eliminate principally water, but also mineral salts and certain pathological and foreign substances which may be present. 2. *The glandular epithelium lining the convoluted tubules*, which excretes waste-products, such as urea, etc. 3. The *constricted portion of the tubules*, serving to prevent (according to the Cohnheim-Bauman theory) the too rapid escape of water, thus allowing time for its absorption in cases where it is desirable that the water be retained in the system.

The functional activity of these various structures is regulated by the nervous mechanism through its influence upon the blood-supply. For example, the supply of blood to the glomeruli is influenced largely by the size of the blood-vessels, regulated by the vaso-constrictor and vaso-dilator nerves; but it has not been proven that the secretory cells are in any way affected by the nervous mechanism.

Diuretics act—

1. By increasing the general blood-pressure.

2. By causing local dilatation of the renal arterioles.

[1] The drugs marked with an asterisk are described elsewhere in the present work.

3. By directly stimulating the glandular secreting renal structures.
4. By simple mechanical force.

The following table, modified from Brunton's work on Pharmacology, Therapeutics, and Materia Medica, serves to elucidate the methods by which the various diuretic agents probably exert their influence:

- **Raise arterial pressure.**
  - Generally . .
    - Increased cardiac action.
      - Digitalis,*
      - Alcohol.*
    - General vascular contraction.
      - Digitalis,*
      - Strophanthus,*
      - Squill,
      - Scoparius,*
      - Convallaria,*
      - Strychnine,*
      - Caffeine,*
      - Erythrophleum (cold to the skin).
- **Locally on kidneys.**
  - Contract efferent vessels.
    - Act on the vasomotor centers.
      - Same as above?
    - Locally on kidney.
      - Scoparius,*
      - Buchu,
      - Uva Ursi,
      - Juniper,
      - Turpentine,
      - Copaiba,
      - Cantharides.*
  - Dilate efferent vessels.
    - Act either on vasomotor centers or locally on renal vessels.
      - Nitrites,*
      - Alcohol.*
- **Act on secreting nerves and renal cells.**
  - Increase water excreted . . . . .
    - Urea,
    - Caffeine,*
    - Diuretin,
    - Calomel.*
  - Increase water and solids excreted .
    - Colchicum,*
    - Liquor Potassæ,*
    - Potassium Acetate,*
    - Potassium Citrate,*
    - Potassium Nitrate,*
    - Sodium Citrate *
    - and other salines.
- **By simple mechanical action . . . . . .**
  - Water, local bleeding, dry cupping, warm fomentations.

The secretion of urine is considerably influenced by the activity of the skin and bowels; for instance, when the cutaneous glands are stimulated and there is free perspiration, a diminished urinary secretion ensues. The functional activity of the skin and sudo-

riparous glands depends greatly upon the amount of blood supplied to them. Whatever augments the flow of blood to these structures increases the secretion of the sweat-glands. Consequently, external warmth dilates the cutaneous blood-vessels and promotes diaphoresis, while cold contracts the cutaneous vessels, diverting the flow of blood to the internal organs, thereby increasing the secretion from the kidneys and lessening that from the skin.

It will be seen, therefore, that the functions of the skin and kidneys are compensatory, the compensation being also partially observable in the mutual relations between the bowels and kidneys. It is well known that when there is active purgation, with frequent watery movements from the bowels, the amount of urine secreted is proportionally diminished.

Any drug which increases the general blood-pressure and forces a larger blood-supply into the kidneys augments the pressure in the glomeruli, distending the capsule and enlarging the area of the osmotic membrane, which action, combined with an increase in the circulation, promotes and facilitates filtration, thereby augmenting the amount of urine.

The membrane lining the inner capsule of the glomerulus is covered with a single layer of cubical epithelium possessing a secretory function, rendered more active in accordance with the physiological fact that the greater the blood-supply to a gland or secreting structure, the greater its functional activity.

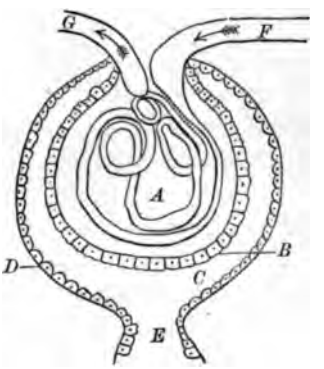

FIG. 15.—*A*, glomerules of capillary blood-vessels; *B*, cubical or secreting cells covering the membrane surrounding the capillary plexus; *C*, space between the two layers opening into a convoluted tubule; *D*, the external layer covered by flattened epithelial cells; *E*, convoluted tubule lined with a single layer of nucleated polyhedral epithelium; *F*, *afferent* artery entering the Malpighian corpuscle, dividing in the interior into a dense, convoluted capillary plexus, which finally leads out of the corpuscle by *G*, a small, *efferent* vessel comparable to a vein, at a point opposite to that where the *afferent* vessel enters the Malpighian corpuscle.

The blood-pressure in the glomeruli, as has been said, may be increased by additional pressure in the general circulation. It may be raised also locally through dilatation of the *afferent* blood-vessel supplying the Malpighian corpuscle, or contraction of the *efferent* vessels, allowing a smaller quantity of blood to escape from the glomerules.

By referring to the foregoing tabular view we may ascertain the drugs acting upon the general and those affecting the local circulation.

The preceding diagram (Fig. 15) will serve to elucidate the action taking place in the glomeruli.

The secreting structures of the convoluted tubules are stimulated by the influence of certain drugs which are carried in the blood, acting as excitants upon the secreting cells. This necessarily requires an extra supply of blood to the part furnishing material for the extra secretion. By reference to the table on page 632 it will be seen what diuretics act upon these structures.

The subjoined diagram (Fig. 16) shows the structures concerned with the functional activity of the kidney.

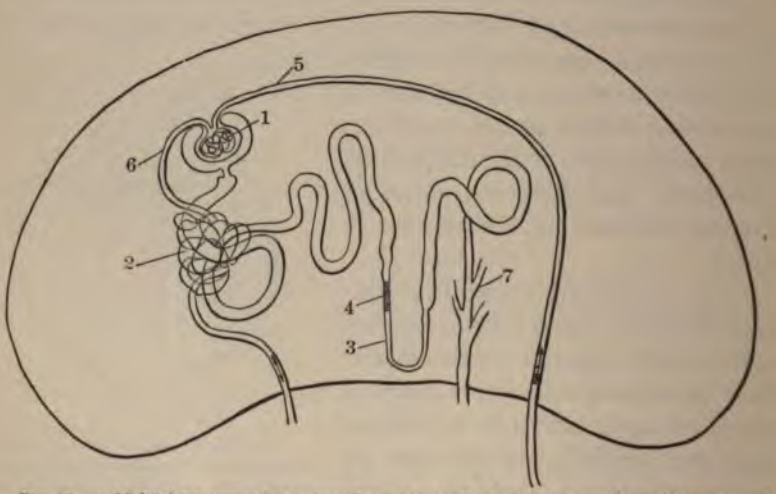

FIG. 16.—1, Malpighian corpuscle; 2, convoluted tubule with capillary plexus from *efferent* vessel; 3, constricted portion of the tubule; 4, unstriped muscle-fibers surrounding the constricted portion; 5, *afferent* blood-vessel leading into the Malpighian body; 6, *efferent* vessel leading out of the Malpighian corpuscle; 7, the collecting tube.

The imbibition of large amounts of water, while increasing the blood-pressure to some extent, mechanically increases the amount of water eliminated by the kidney. This is commonly known as the "flushing action," and renders the urine more dilute.

In congested conditions of the kidneys certain remedial measures—such as local venesection, dry cupping, warm fomentations, etc.—promote renal secretion.

Therapeutics.—1. *To remove excessive accumulation of fluid in*

the tissues and serous cavities of the body when the blood-pressure is low.

For this purpose the most efficient service is derived from the use of drugs which act by increasing the systemic blood-pressure, and stimulating the secreting cells of the kidneys.

Ordinarily, the agents most beneficial in *cardiac dropsy* or dropsies due to venous congestion are digitalis, calomel, scoparius, squill, diuretin, etc.

2. *To remove excess of fluid from the body when the blood-pressure is about normal*, as in cases of *hepatic cirrhosis* with *dropsy.*

The remedies found to be most efficient in these conditions are diuretin, copaiba, and calomel, although frequently saline purgatives, by ridding the peritoneal cavity of excess of water and preventing the accumulation of fluid by lowering the abnormally high blood-pressure in the portal circulation, prove more beneficial than diuretics.

3. *To remove water from the blood when the arterial pressure is abnormally high.*

For this purpose diuretics are indicated in the early stages of many acute diseases, such as the *eruptive fevers*, *tonsillitis*, *bronchitis*, etc. In these cases agents which dilate the cutaneous blood-vessels, such as spirit of nitrous ether, etc., should be employed. Diaphoretics and cathartics are likewise beneficial.

4. *To remove from the blood injurious waste products and poisonous substances.*

For this purpose drugs which stimulate the convoluted tubules and increase oxidation should be given, such as potassium nitrate and bitartrate, the lithium salts, turpentine, juniper, diuretin, and the remedies mentioned under "Lithontriptics."

The foregoing remedies will be found useful in diseases associated with *rheumatic*, *gouty*, and *uric-acid diatheses*, as well as in many acute diseases where there is rapid accumulation of deleterious, retrograde material.

5. *To lessen the acidity of the urine.*

The alkalies and the alkaline salts of the organic acids are the most useful agents for this purpose, being serviceable in such conditions as *gonorrhea* and acute inflammatory states of the genito-urinary tract. In debilitated conditions there is quite often an excessive acidity of the urine, irritating the mucous membrane and causing frequent micturition. In such cases the alkaline diuretics or alkaline mineral waters are of service.

6. *To increase the acidity of the urine.*

This is necessary when, from any cause, there is ammoniacal decomposition of the urine, as in *cystitis*. In such cases benzoic acid is probably the most beneficial remedy, though the salicylates, salol, and the volatile oils, etc. may also prove useful.

7. *To prevent the formation of urinary concretions or to dissolve them when formed*, as in cases of *renal calculi*, etc.

For these purposes the drugs included under "Lithontriptics" are the most efficient.

8. *To dilute the urine.*

This process is necessary to prevent the deposit of urinary solids from forming *calculi* in the kidneys or bladder. For this purpose water or the alkaline mineral waters, taken in large quantities, will prove most useful.

Administration.—Diuretics are often very uncertain in their action, in health many of them apparently exerting no influence upon the kidneys, and in diseased conditions not infrequently proving inert. They are more certain in their action when employed in combination—that is, a union of drugs which act both generally upon the systemic circulation and locally upon the various secreting structures of the kidneys. Diaphoretics, being diverse in their action, should not be given with diuretics.

When administered, diuretics should be freely diluted with water. The patient's skin should be kept cool and the bowels prevented from acting too freely, in order that the full benefit of this class of remedies may be obtained.

The diuretic drugs not described elsewhere in the present work are herewith considered in detail.

Scilla—Scillæ—Squill. *U. S. P.*

Origin.—The bulb of *Urginea maritima* (L.) Baker, a plant indigenous in the basin of the Mediterranean from Syria westward to the coast of the Atlantic. The bulb is deprived of its dry, membranaceous outer scales and cut into thin slices, the central portions being rejected.

Description and Properties.—Occurring in narrow segments about 2 inches (5 Cm.) long, slightly translucent, yellowish-white or reddish, brittle and pulverizable when dry, tough and flexible after exposure to damp air; inodorous; taste mucilaginous, bitter, and acrid. The drug contains three active principles—*scillipicrin*,

scillitoxin (both acting upon the heart), and *scillin* (an emetic principle)—together with various unimportant substances, such as mucilage, sugar, etc.

Dose.—1–4 grains (0.06–0.25 Gm.).

Official Preparations.

Acētum Scĭllæ—Acēti Scĭllæ—Vinegar of Squill (10 per cent.).—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Extrăctum Scĭllæ Flŭidum—Extrăcti Scĭllæ Flŭidi—Fluid Extract of Squill.—*Dose*, 1–4 minims (0.065–0.25 Cc.).

Sўrupus Scĭllæ—Sўrupi Scĭllæ—Syrup of Squill (45 per cent. of the Acetum).—*Dose*, 30–60 minims (2.0–4.0 Cc.).

Sўrupus Scĭllæ Compŏsitus—Sўrupi Scĭllæ Compŏsiti—Compound Syrup of Squill.—*Dose*, 15 minims–2 fluidrachms (1.0–8.0 Cc.). Fluid Extract 8 per cent., with Fluid Extract of Senega 8 per cent. and Tartar Emetic 2 per cent., or ⅛ grain (.008 Gm.) to 1 fluidrachm (4.0 Cc.).

Tinctūra Scĭllæ—Tinctūræ Scĭllæ—Tincture of Squill (15 per cent.).—*Dose*, 5–20 minims (0.3–1.3 Cc.).

Antagonists and Incompatibles.—The action of squill upon the circulatory system is antagonized by the cardiac depressants. Tannic acid is incompatible.

Synergists.—The diuretic action of squill is enhanced by the diuretics and many of the cardiac stimulants. As an expectorant the drug is aided by senega and tartar emetic.

Physiological Action.—*Externally and Locally.*—There is no action of special importance. Applied to mucous membranes, however, squill acts as an irritant.

Internally.—Digestive System.—Large doses of the drug excite nausea, vomiting, and purging. Excessive amounts may produce gastro-enteritis.

Circulatory System.—The action of squill upon the heart and blood-vessels resembles that of digitalis, although as a cardiac stimulant digitalis is the more powerful.

Nervous System.—Poisonous doses produce marked cerebral symptoms, and in warm-blooded animals may occasion paralysis and convulsions.

Respiratory System.—The bronchial mucus is increased and expectoration facilitated by small doses of squill. Toxic doses render the respiration rapid and shallow.

Absorption and Elimination.—The active principles of squill are quickly diffused through the blood, being eliminated chiefly by the kidneys and bronchial mucous membrane.

In the passage of squill through the kidneys the renal epithe-

lium is stimulated by the drug, which influence, together with the drug's action upon the systemic circulation, renders squill an active and valuable diuretic, increasing not only the amount of urine, but also the quantity of inorganic solids.

Very large doses irritate and inflame the kidneys, resulting in strangury and hematuria, with occasionally entire suppression of urinary flow.

Untoward Action.—This does not differ essentially from the symptoms of "Poisoning."

Poisoning.—In toxic doses squill acts as an acro-narcotic poison. The symptoms produced by excessive doses are—nausea, violent vomiting, serous and bloody diarrhea, severe griping, a sensation of burning in the throat, vesical tenesmus accompanied by pain, bloody urine, and perhaps entire suppression of the urinary flow. The pulse is feeble and slow or sometimes rapid, the symptoms terminating in collapse and death, occasionally preceded by convulsions.

Treatment of Poisoning.—The stomach should be evacuated and demulcent drinks freely given. Opium may be necessary to relieve pain, while diffusible stimulants serve to counteract cardiac and respiratory depression.

Therapeutics.—SQUILL is not used externally and locally. It has been employed internally as a diuretic in *dropsy*. When associated with digitalis and calomel it is an exceedingly active diuretic in cases of *cardiac dropsy*, *chronic pleurisy*, and *pericarditis with effusion*.

Squill is an efficient expectorant, the VINEGAR, SYRUP, and COMPOUND SYRUP OF SQUILL being useful preparations in *subacute* and *chronic forms* of *bronchitis*, particularly when the sputum is tenacious and with difficulty expelled.

Contraindications.—Squill should not be employed in cases of acute diseases of the kidneys. It is also inadmissible in acute bronchitis and in phthisis.

Administration.—Any of the preparations of the drug may be given, to be prescribed well diluted with syrup or glycerin.

Inasmuch as the diuretic action of squill ceases after a while, the doses should be repeated and gradually enlarged until some untoward action supervenes, when further increase should be suspended.

Because of its too irritating properties the drug is seldom given alone when desired for its diuretic action.

Owing to the free acetic acid which it contains, syrup of squill is incompatible with ammonium carbonate and other alkalies.

Erythrophlēum—Erythrophlēi—Erythrophleum.

(CASCA BARK.)

Origin.—A glucosid obtained from the bark of *Erythrophlæum Guinense* Don, known under the names of *Casca bark*, *Sassy bark*, and *Ordeal bark*. The tree is a native of West Africa, the plant being used by the natives as an *ordeal* in witchcraft.

Description and Properties.—Erythrophlein hydrochloride, the salt usually employed, occurs in the form of whitish crystals, soluble in water.

Dose.—$\frac{1}{60}$–$\frac{1}{12}$ grain (.001–.005 Gm.).

Physiological Action and Therapeutics.—The powdered bark when inhaled causes violent sneezing. The tincture of the bark, or the glucosid, when taken in poisonous doses occasions nausea, vomiting, purging, intense headache, intoxication, convulsions, and death.

In medicinal doses the drug affects the circulatory system after the manner of digitalis, and acts upon the kidneys as an active diuretic. It was at one time supposed to be a powerful local anesthetic; further examination, however, has proved the claim to be unfounded.

Casca bark or its glucosid has been employed in *intermittent fever*, *diarrhea*, *dysentery*, and *dyspepsia*. Its chief medical uses are in valvular diseases of the heart and as a diuretic in *cardiac* and *renal dropsies*.

Administration.—A tincture of the bark (10 per cent. strength) may be given internally, diluted with water, in doses of 5–10 minims (0.3–0.6 Cc.). Erythrophlein hydrochlorate is usually given hypodermically.

Būchu—Būchu—Buchu. *U. S. P.*

Origin.—The leaves of *Barosma betulina* (Thunberg) Bartling et Wendland, and *Barosma crenulata* (L.) Hooker, plants or shrubs attaining a height of several feet, indigenous in the southern portion of Africa, particularly in various parts of Cape Colony.

Description and Properties.—The leaves are $\frac{1}{2}$ to $\frac{3}{4}$ inch (12 to 19 Mm.) long, roundish-obovate, with a rather wedge-shaped base, or varying between oval and obovate, crenate or serrate, with a gland at the base of each tooth, dull yellowish-green, thickish,

pellucid-punctate; odor and taste strongly aromatic, somewhat mint-like, pungent, and bitterish. Buchu contains from 1 to 1.56 per cent. of a *volatile oil*, which, on exposure to a low temperature, releases *barosma camphor* or diosphenol, a stearopten. The bitter principle of buchu is *rutin;* resin is also present.

Dose.—15–30 grains (1.–2. Gm.).

Official Preparation.

Extrăctum Būchu Flūidum—Extrăcti Būchu Flūidi—Fluid Extract of Buchu.—*Dose*, 15–30 minims (1.–2. Cc.).

Physiological Action and Therapeutics.—Externally and locally buchu has no action of importance. When ingested it acts as a carminative, in small doses occasioning a feeling of warmth, but in excessive doses acting as an irritant.

Upon the circulation the influence of the drug is that of a mild stimulant.

Its active constituents are rapidly diffused through the blood, and are eliminated principally by the kidneys, the bronchial mucous membrane sharing in the excretory process.

Buchu increases the fluid and solid constituents of the urine, imparting to it a peculiar aromatic odor. The drug acts as a tonic astringent and disinfectant to the mucous membranes, from which it is eliminated, diminishing the secretions.

If taken for too long a period, irritation and inflammation of the kidneys are apt to ensue because of excessive stimulation.

The drug is chiefly employed as a stimulant diuretic and expectorant in catarrhal conditions of the genito-urinary organs and bronchial tubes. Buchu is therefore of service in *urethritis*, *gonorrhea*, *gleet*, *chronic cystitis*, *incontinence of urine* due to want of muscular tone, *pyelitis*, etc. The drug has also proved beneficial in certain cases of *chronic bronchitis*, and has even been recommended in *chronic rheumatism* and *lithemia*.

Contraindications.—Buchu is contraindicated in acute inflammation of the kidneys.

Administration.—The fluid extract and the infusion are the only preparations employed. They should be given freely diluted with water.

Ūva Ŭrsi—Ūvæ Ŭrsi—Uva Ursi. *U. S. P.*

(Bearberry.)

Origin.—The leaves of *Arctostaphylos Uva Ursi* (L.) Sprengel., a trailing evergreen plant distributed throughout the northern por-

tion of North America, extending as far south as New Jersey and westward to Colorado. The plant is also found in most parts of Europe and in Northern Asia.

Description and Properties.—Leaves very short-stalked, obovate or oblong-spatulate, coriaceous, about $\frac{4}{5}$ inch (2 Cm.) long and $\frac{1}{4}$ to $\frac{1}{3}$ inch (6 to 8 Mm.) wide, obtuse, with slightly revolute edges, upper surface with depressed veins, lower surface distinctly reticulate; odor faint, hay-like; taste strongly astringent and somewhat bitter.

Uva ursi contains two bitter glucosids, *arbutin* and *ericolin*, and a tasteless principle, *urzone*, besides tannic and gallic acids.

Dose.—15–60 grains (1.–4. Gm.).

Official Preparations.

Extractum Uvæ Ursi—Extracti Uvæ Ursi—Extract of Uva Ursi.—*Dose*, 5–15 grains (0.3–1.0 Gm.).

Extractum Uvæ Ursi Fluidum—Extracti Uvæ Ursi Fluidi—Fluid Extract of Uva Ursi.—*Dose*, 15–60 minims (1–4 Cc.).

The **Physiological Action and Therapeutics** of uva ursi are analogous to those of buchu.

Juniperus—Juniperi—Juniper.

(Juniper Berries.)

Origin.—The fruit of *Juniperus communis* (L.), an evergreen tree indigenous in the northern hemisphere and found in the United States and Canada and in Europe.

Description and Properties.—Berries globular, about the size of a large pea, externally of a glossy, purplish-black color, covered with a grayish bloom. They have an aromatic, balsamic odor, and a sweet terebinthinate, bitterish, and slightly acrid taste. Juniper contains a volatile oil; also juniperin, sugar, wax, fat, etc.

Dose.—15–60 grains (1.–4. Gm.).

Oleum Juniperi—Olei Juniperi—Oil of Juniper.
U. S. P.

Origin.—A volatile oil distilled from the fruit of *Juniperus communis*.

Description and Properties.—A colorless or faintly greenish-yellow liquid, becoming darker and thicker through age and exposure to air, having the characteristic odor of juniper and

a warm, aromatic, somewhat terebinthinate and bitterish taste. Soluble in about four times its volume of alcohol, forming a more or less turbid liquid, which is neutral or slightly acid to litmus-paper.

Dose.—5–15 minims (0.3–1.0 Cc.).

Official Preparations.

Spĭritus Junĭperi—Spĭritus Junĭperi—Spirit of Juniper.—*Dose*, 1–8 fluidrachms (4.0–30.0 Cc.). Formula: Oil of Juniper, 5; Alcohol, 95 parts.

Spĭritus Junĭperi Compŏsitus—Spĭritus Junĭperi Compŏsiti—Compound Spirit of Juniper.—Formula: Oil of Juniper, 8; Oil of Caraway, 1; Oil of Fennel, 1; Alcohol, 1400; Water sufficient to make 2000 parts.—*Dose*, 2–4 fluidrachms (8.0–15.0 Cc.).

Unofficial Preparations.

Extrăctum Junĭperi Frŭctus Flŭidum—Extrăcti Junĭperi Frŭctus Flŭidi—Fluid Extract of Juniper Berries.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

Infūsum Junĭperi—Infūsi Junĭperi—Infusion of Juniper.—1 ounce (31. Gm.) of Juniper to 1 pint (473. Cc.) of Water.—*Dose*, 2–4 fluidounces (60.–118. Cc.).

Physiological Action and Therapeutics.—Juniper in its action resembles buchu, being a stimulant diuretic. Under certain conditions it acts as a diaphoretic. It is a tonic to the stomach and a mild aphrodisiac.

The volatile oil, which is the active constituent of juniper, diffuses through the blood with great facility, stimulating the heart, and, in dropsical conditions, increasing the flow of urine. In health, however, the amount of urine is diminished, while that of urea is augmented.

Juniper is used for the same purposes as buchu—being superior to the latter drug perhaps—especially in various *dropsies* and *passive congestion of the kidneys.*

Contraindications.—The same as for buchu.

Administration.—Any of the preparations may be given, gin being a popular diuretic.

Ōleum Terebinthīnæ—Ōlei Terebinthīnæ—Oil of Turpentine. *U. S. P.*

Origin.—A volatile oil distilled from turpentine—a concrete oleoresin obtained from *Pinus palustris* Miller and other species of *Pinus.*

Description and Properties.—A thin, colorless liquid, of a characteristic odor and taste, both of which become stronger and less agreeable with age and exposure to air. Soluble in three

times its volume of alcohol. Oil of turpentine should be kept in well-stoppered bottles, protected from light.

Dose.—5–15 minims (0.3–1.0 Cc.), in emulsion.

Official Preparations.

Linimĕntum Terebinthīnæ—Linimĕnti Terebinthīnæ—Turpentine Liniment (35 per cent. with resin cerate). For external use.

Ōleum Terebinthīnæ Rectificātum—Ōlei Terebinthīnæ Rectificāti—Rectified Oil of Turpentine.—*Dose*, 5–15 minims (0.3–1.0 Cc.).

Antagonists and Incompatibles.—The motor depressants and agents increasing waste therapeutically antagonize the action of turpentine. Bromine, iodine, and nitric and sulphuric acids are incompatible, explosion occurring with the first two, and combustion taking place by mixture with the acids named.

Synergists.—The therapeutic actions of turpentine are enhanced by buchu, cubeb, copaiba, oil of sandalwood, and the diffusible and alcoholic stimulants.

Physiological Action.—*Externally and Locally.*—Oil of turpentine is antiseptic, hemostatic, irritant, counter-irritant, rubefacient, vesicant, and a parasiticide. Its action resembles closely that of the volatile oils as described under "Aromatics."

When applied to the epidermis the drug dilates the cutaneous blood-vessels, occasioning a sensation of heat and producing redness of the skin, and, if the oil be applied with inunction for any length of time, vesication ensues, with, occasionally, intractable ulcerations. The fumes of oil of turpentine when inhaled cause great irritation of the eyes and the respiratory passages.

The drug is readily absorbed from the unbroken skin.

Internally.—Digestive System.—When taken into the mouth turpentine produces a burning, pungent taste and an immediate and augmented salivary secretion. Swallowed in immoderate amounts, the drug occasions a sensation of heat in the epigastrium, with increased peristaltic action and secretion. The intestines are similarly affected, the intestinal peristalsis being greatly augmented, the drug acting as an efficient carminative.

Large doses of turpentine produce severe, burning pain in the stomach and bowels, accompanied by nausea, vomiting, and purging, the feces often containing blood.

The drug is an efficient anthelmintic for tape-worm.

Circulatory System.—Turpentine is a cardiac stimulant, increasing the force and rapidity of the heart's action and raising arterial ten-

sion by direct cardiac influence. The blood-vessels are contracted by the drug, which may account for its hemostatic properties. Very large doses slow the heart by stimulating the vagus inhibitory center.

Nervous System.—Small doses increase and large doses diminish reflex excitability. Large doses produce giddiness, mental exhilaration, and incoherence of ideas, followed by dulness and occasionally coma.

There is incoördination of movements, resulting in unsteady gait, great muscular weakness, and diminished sensation, usually preceding the impairment of voluntary motion.

Respiratory System.—The effect of inhaled oil of turpentine on the respiratory passages has been described. When ingested the drug increases and disinfects the bronchial secretion. Small doses increase and large doses diminish the respiratory movements.

Absorption and Elimination.—Oil of turpentine is rapidly diffused in the blood, in moderate doses stimulating the kidneys and increasing the flow of urine, to which it imparts the odor of violets. Large doses irritate the kidneys, lessening the amount of urine, rendering it highly colored, and in some cases producing albuminuria, hematuria, and even total suppression. There are present priapism and a frequent desire to micturate.

Turpentine is rapidly eliminated from the system, not only by the kidneys, but by the skin, and bronchial and intestinal mucous membranes as well.

Temperature.—The drug is a mild antipyretic.

Untoward Action.—Erythema and eczematous eruptions are produced by both the ingestion and the local application of turpentine. In susceptible individuals small doses may occasion serious disturbances of the genito-urinary and gastro-intestinal tracts, such as strangury, painful erections, salivation, and stomatitis.

The administration of repeated doses of oil of turpentine may produce peculiar nervous manifestations, such as headache, drowsiness, dizziness, and a sense of mental vacuity.

Poisoning.—Few cases are recorded of death resulting from the ingestion of excessive amounts of turpentine, owing to the fact that the greater amount of the drug passes away through the bowels.

The symptoms produced by very large doses are—great muscular weakness, abolition of reflexes, and violent vomiting and purging, with bloody evacuations from the bowels. There is great

irritation of the genito-urinary tract, with constant efforts to micturate, hematuria or entire suppression of urine, painful priapism, and violent strangury.

The skin is moist, and the face flushed or cyanosed, while dilatation of the pupils, slow, labored, and stertorous breathing, and occasionally paroxysms of convulsive coughing, may be attendant symptoms.

Either great mental excitement or profound insensibility may be present. The heart and circulatory system are greatly depressed, death, when occurring, being usually the result of cardiac failure.

Treatment of Poisoning.—The stomach should be at once evacuated, and elimination favored by every possible means. The free administration of demulcent drinks is advisable, while to relieve pain opium may be given. Other symptoms should be treated according to their indications.

Therapeutics.—*Externally and Locally.*—OIL OF TURPENTINE is an efficient counter-irritant, being employed as such in *lumbago*, *myalgia*, *neuralgia*, *rheumatic pains*, *bronchitis*, *pleurisy*, and various forms of *chronic inflammation*. A TURPENTINE STUPE is perhaps the most effective method in the local application of the drug. It is applied as follows: (1) A flannel is wrung out of hot water, sprinkled well with the oil and allowed to remain in contact with the affected part from five to twenty minutes, as indicated by the sensibility of the skin. Care must be taken in the preparation of the flannel lest the patient be chilled or scalded. (2) A vessel containing the oil is placed in hot water and a flannel wrung from the oil applied as desired.

A TURPENTINE STUPE is perhaps the most grateful and efficient local application in *peritonitis*.

Owing to its antiseptic and hemostatic properties the OIL OF TURPENTINE is frequently and beneficially employed as a dressing for *lacerated wounds*.

The drug is an active parasiticide, and has been used successfully in the treatment of *tinea tonsurans*, etc. It has also been favorably recommended, when diluted with some bland oil, as a remedy for *alopecia areata* and *psoriasis*.

TURPENTINE serves a useful purpose in many diseases of the *ear* and *throat*.

Cecchini uses turpentine in the treatment of *caries of the temporal bone*.

J. Solis Cohen recommends the VAPOR OF TURPENTINE as an

efficient means of allaying the *cough* and *irritation* occasioned by *acute laryngeal catarrh.*

Erichsen employs the drug as a hemostatic to check *bleeding after excision of the tonsils.*

The inhalation of the OIL OF TURPENTINE lessens *pulmonary hyperemia* and *excessive bronchial secretion.*

The drug has been recommended as a local application in *diphtheria* after the removal of the membranes.

Internally.—TURPENTINE is a valuable remedy for *gastric* or *intestinal flatulence*, particularly when the condition arises from an atonic state of the muscles of the stomach or intestines.

The drug is frequently employed in *typhoid fever*, not only for the relief of *tympanitis*, but also to check *intestinal hemorrhage.*

In *chronic intestinal catarrh*, as well as in a catarrhal condition of any mucous membrane, turpentine is a valuable remedial agent.

The drug is an effectual hemostatic when given internally, having been successfully employed in *hemoptysis*, *hematemesis*, *hematuria*, *menorrhagia*, *purpura hæmorrhagica*, etc.

TURPENTINE is a very powerful anthelmintic against tape-worm. When given for this purpose it should be administered in a single large dose, from 4–8 fluidrachms (15.–30. Cc.), together with a large dose of some purgative like castor-oil to ensure the prompt elimination of the turpentine from the bowels.

As a cardiac stimulant turpentine is often employed in low and depressed conditions of the circulatory system, such as *typhoid*, *yellow*, and *puerperal fevers*, *pneumonia*, *capillary bronchitis*, *traumatic erysipelas*, etc.

As has been suggested, the drug has a decided and beneficial influence upon relaxed and chronic catarrhal conditions of mucous membranes, rendering this remedy of great value in *bronchorrhea*, *chronic bronchitis*, *emphysema* with marked bronchial catarrh, etc. This action upon the mucous membranes, together with the diuretic properties of the drug, renders turpentine an exceedingly valuable remedy in the treatment of *gleet*, *subacute gonorrhea*, *chronic cystitis*, *spermatorrhea*, *prostatorrhea*, *pyonephrosis*, etc.

OLD OZONIZED OIL OF TURPENTINE is one of the best antidotes and prophylactics in cases of *phosphorus-poisoning.*

So-called *atonic incontinence of urine* is frequently benefited by the drug; and Durand has highly recommended OIL OF TURPENTINE as a solvent of *biliary calculi.*

Contraindications.—Oil of turpentine should never be given to patients suffering from Bright's disease or acute inflammation of the gastro-intestinal and genito-urinary tracts.

The drug should be withheld in cases of active hemorrhage in plethoric subjects; and, while some authorities recommend turpentine in hematuria, others class this condition as a contraindication. If given in the latter condition, the dose should be small and cautiously repeated.

Administration.—Small doses of turpentine may be given on lumps of cut sugar, but usually preference is given to administration in the form of a capsule or an emulsion, 1 fluidrachm (4. Cc.) of mucilage of acacia, if properly manipulated, emulsifying ½ fluidrachm (2. Cc.) of oil of turpentine with 1 fluidounce (30. Cc.) of water. Flavoring substances can be incorporated in the emulsion, rendering the preparation not unpleasant to the taste.

In giving turpentine its tendency to produce untoward manifestations, particularly of the genito-urinary tract, should be remembered, care being invariably exercised in the administration of the drug.

For external use the drug may be used in full strength, diluted with some bland oil or ointment, or applied in the form of stupes.

Turpentine is sometimes employed as an enema, in which case it should, of course, be mixed with some bland oil and mucilage of acacia in the form of an emulsion.

Copaïba—Copaïbæ—Copaiba. *U. S. P.*

(Balsam of Copaiba.)

Origin.—The oleoresin of *Copaiba Langsdorffii* (Desfontaines) O. Kuntze, and other species of *Copaiba*, lofty forest trees, natives of Central America.

Description and Properties.—A transparent or translucent, more or less viscid liquid of a pale-yellow to brownish-yellow color, having a peculiar aromatic odor and a bitter acrid taste. Insoluble in water; readily soluble in absolute alcohol, ether, chloroform, carbon disulphide, benzin, and fixed and volatile oils.

Copaiba contains a *volatile oil*, *two resins*, *copaibic acid* (soluble in absolute alcohol and in ammonia), and a bitter principle. The term "balsam" is a misnomer, since the drug contains neither benzoic nor cinnamic acid.

Dose.—5–30 minims (0.3–2.0 Cc.), in emulsion or in capsule.

Official Preparation.

Măssa Copaībæ—Măssæ Copaībæ—Mass of Copaiba.—Formula: Copaiba, 94; Magnesia, 6; Water, a sufficient quantity.—*Dose*, 5–30 grains (0.3–2.0 Gm.).

Ōleum Copaībæ—Ōlei Copaībæ—Oil of Copaiba. *U. S. P.*

Origin.—A volatile oil distilled from Copaiba.

Description and Properties.—A colorless or pale-yellowish liquid, having the characteristic odor of copaiba and an aromatic, bitterish, and pungent taste. Soluble in about ten times its volume of alcohol, forming a slightly turbid liquid, which is neutral to litmus-paper. The drug should be kept in well-stoppered bottles, in a cool place.

Dose.—5–15 minims (0.3–1 Cc.).

Resīna Copaībæ—Resīnæ Copaībæ—Resin of Copaiba. *U. S. P.*

Origin.—The residue left after distilling off the volatile oil from Copaiba.

Description and Properties.—A yellowish or brownish-yellow, brittle resin, having a slight odor and taste of copaiba. Soluble in alcohol, ether, chloroform, carbon disulphide, benzol, and amylic alcohol.

Dose.—5–15 grains (0.3–1.0 Gm.).

Antagonists and Incompatibles.—Copaiba is antagonized by the same drugs which antagonize turpentine. It is pharmaceutically incompatible with aqueous preparations.

Synergists.—The same as for turpentine.

Physiological Action.—*Externally and Locally.*—Copaiba has no influence of importance, being but slightly stimulant to the skin.

Internally.—Digestive System.—Its action is analogous to that of turpentine and the volatile oils. The ingestion of the drug, even in small doses, is almost always succeeded by eructations tasting of copaiba.

Copaiba exerts no special influence upon the circulatory, nervous, and respiratory systems.

Absorption and Elimination.—The drug enters the circulation with facility, and is slowly eliminated by the skin and mucous membranes generally, although chiefly by the kidneys. The resin which the drug contains is a powerful stimulant of the genito-

urinary structures, increasing the quantity, and to some extent the solid constituents, of the urine. Large doses irritate the kidneys, occasionally producing strangury, bloody urine, pain in the bladder, etc.

Under the use of copaiba albumin is sometimes found in the urine. Frequently the nitric-acid test with urine may give a reaction as if for albumin, the conclusions being then erroneous, since the resin of copaiba eliminated in the urine is by the action of nitric acid precipitated as a milky cloud, readily differentiated from albumin by heating the urine or mixing it with alcohol, by both of which means the resinous precipitate is dissolved.

Copaiba acts as a stimulant and disinfectant at the points of elimination, in medicinal amounts increasing secretion and imparting to the secretion from the kidneys, bronchial mucous membrane, and skin a peculiar, fragrant odor.

Untoward Action.—It often happens that after a few days' administration of copaiba there is produced in certain individuals an eruption, usually resembling roseola, which later may be transformed into true papules. Or the eruption may be scarlatiniform in character or a true eczema ensue. These eruptions are first noticeable on the upper and lower extremities, backs of the hands and knees, malleoli, etc., and are attended with intense itching.

Under the prolonged use of the drug there may occur serious disturbances of the digestive and genito-urinary tracts.

Poisoning.—In addition to the untoward manifestations already mentioned, very large doses of copaiba produce symptoms similar to those described under Turpentine. Cases have been recorded in which excessive amounts occasioned paralysis and tetanoid attacks.

Treatment of Poisoning.—This should be the same as prescribed under Turpentine.

Therapeutics.—*Externally and Locally.*—The use of COPAIBA has recently been revived by Dr. Beach of Boston as a protectant antiseptic and antiphlogistic dressing for the treatment of *chronic* and *indolent ulcers.*

It has been advocated as an excellent application in many chronic diseases of the skin, such as *psoriasis*, *lupus*, etc. The drug has proved valuable in frost-bites, while Shoemaker mentions it as a useful remedy to apply to "*thickened* and *irritable conditions* of the *tongue*, *mouth*, *rectum*, *vagina*, *uterus*, and *urethra.*" The same authority affirms that the drug sometimes completely re-

moves the discharge of *gleet* when applied directly to the urethra.

Internally.—The principal use of COPAIBA is as a stimulant and disinfectant of the genito-urinary tract in cases of *gleet, subacute gonorrhea, vaginitis, cystitis, pyelitis,* etc.

In *ascites* and *dropsical conditions,* particularly those due to hepatic and cardiac disease, the RESIN OF COPAIBA proves a very efficient and reliable diuretic. Under prolonged use, however, a tolerance appears to be established.

COPAIBA is a valuable remedy in *chronic bronchitis* and *bronchorrhea* with offensive expectoration.

The drug has been at times given internally with good results in *psoriasis, urticaria,* etc., although the internal use of copaiba in these disorders is less common than formerly.

The drug has found enthusiastic advocates as a remedy in *chronic diarrhea* and *dysentery,* and has also been recommended in *chronic proctitis* and *chronic intestinal catarrh.*

Contraindications.—The same as for turpentine.

Administration.—The methods of administration recommended for turpentine are applicable to this drug. It is claimed that many of the untoward manifestations produced by copaiba may be prevented by giving the drug with an alkali. With this object in view copaiba was associated with magnesia in the "Massa Copaibæ." Yet, while this preparation is perhaps less likely to produce untoward results, it is undoubtedly less active therapeutically than the single drug.

Ōleum Săntali—Ōlei Săntali—Oil of Santal.

U. S. P.

(OIL OF SANDALWOOD.)

Origin.—A volatile oil distilled from the wood of *Santalum album* L., a small tree indigenous in Southern India and portions of the East Indies.

Description and Properties.—A pale-yellowish or yellow, somewhat thickish liquid, having a peculiar, strongly aromatic odor and a pungent, spicy taste; readily soluble in alcohol. It is frequently adulterated with oil of cedar.

Dose.—5–20 minims (0.3–1.2 Cc.).

Physiological Action and Therapeutics.—The action of oil of sandalwood resembles closely that of copaiba, and it may be given for the same purposes as the latter drug, although oil of sandal-

wood is more popular, and ordinarily a more efficient remedy, for *gonorrhea*, particularly in the early stages.

Administration.—The same as in the case of copaiba.

Cubēba—Cubēbæ—Cubeb. *U. S. P.*

Origin.—The unripe fruit of *Piper Cubeba* Linn. fil., a climbing diecious shrub about 20 feet (6 M.) high, indigenous in Java.

Description and Properties.—Globular, about $\frac{1}{6}$ or $\frac{1}{5}$ inch (4 or 5 Mm.) in diameter, contracted at the base into a rounded stipe about $\frac{1}{4}$ or $\frac{2}{5}$ inch (6 or 10 Mm.) long, reticulately wrinkled, blackish-gray, internally whitish and hollow; odor strong, spicy; taste aromatic and pungent. It contains from 5 to 15 per cent. of a *volatile oil*, an odorous principle, *cubebin*, and a diuretic principle, *cubebic acid*, besides resin, fat, wax, and starch.

Dose.—5–60 grains (0.32–4.0 Gm.).

Official Preparations.

Extractum Cubēbæ Flūidum—Extracti Cubēbæ Flūidi—Fluid Extract of Cubeb.—*Dose*, 5–60 minims (0.32–4.0 Cc.).

Ōleoresīna Cubēbæ—Ōleoresīnæ Cubēbæ—Oleoresin of Cubeb.—*Dose*, 15–30 minims (0.32–2.0 Cc.).

Tinctūra Cubēbæ—Tinctūræ Cubēbæ—Tincture of Cubeb (20 per cent.).—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Trochīsci Cubēbæ—Trochīscos (acc.) **Cubēbæ—Troches of Cubeb.** (Each troche contains ⅔ minim (.043 Cc.) of the oleoresin.)—*Dose*, 1 to 6 troches.

Ōleum Cubēbæ—Ōlei Cubēbæ—Oil of Cubeb. *U. S. P.*

Origin.—A volatile oil distilled from Cubeb.

Description and Properties.—A colorless, pale-greenish, or yellowish liquid, having the characteristic odor of cubeb and a warm, camphoraceous, aromatic taste. Soluble in an equal volume of alcohol. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—5–15 minims (0.3–1.0 Cc.).

Antagonists and Incompatibles.—The motor depressants antagonize the action of cubeb.

Synergists.—Buchu, copaiba, oil of santal, black pepper, and many of the aromatics and volatile oils.

Physiological Action.—*Externally and Locally.*—Like the aromatics and drugs containing a volatile oil, cubeb is irritant and rubefacient when applied by inunction.

Internally.—Digestive System.—In medicinal amounts cubeb is an aromatic stomachic, increasing the appetite and improving digestion. As is the case with other drugs of this class, large dosage or the too prolonged use of small amounts irritates the stomach and deranges digestion, cubeb acting as a laxative and occasioning a sensation of heat and discomfort about the rectum.

Circulatory System.—Like other members of the Pepper family, cubeb enters the blood with facility, and increases the force and frequency of the heart's action.

Nervous System.—No important action has been noted.

Respiratory System.—There is no perceptible effect when the drug is given in medicinal doses.

Absorption and Elimination.—Cubeb is absorbed and eliminated with considerable rapidity. It escapes from the system chiefly by the urine, though the skin and bronchial mucous membrane share in the excretory process. The drug acts as an active stimulant and disinfectant to the structures by which it is excreted, and is consequently a diuretic expectorant and mild diaphoretic.

The urine and the amount of uric acid are increased by cubeb, the drug appearing in the urine as a salt of cubebic acid, which may be precipitated by nitric acid, the precipitate resembling that of albumin.

Untoward Action.—Cubeb occasionally produces great disturbance in the gastro-intestinal tract, colicky pains, and diarrhea. The most frequent untoward manifestations, however, are various cutaneous eruptions, appearing in the form of papules, and oftentimes as a diffuse erythema. No febrile symptoms attend these eruptions, which usually disappear shortly after the suspension of the drug.

Poisoning.—Although cubeb is not regarded as a poison, very large doses may be followed by all the symptoms of severe gastro-intestinal irritation.

Treatment of Poisoning.—The indications are to empty the stomach, favor elimination, and treat the patient symptomatically by the use of demulcents, anodynes, stimulants, etc., as necessary.

Therapeutics.—*Externally and Locally.*—The drug is a deservedly popular remedy in many diseases of the *nose* and *throat.* The insufflation of an impalpable powder of cubeb or the inhalation of smoke from the burning drug is an efficient palliative to the sense of oppression arising from *turgescence of the nasal mucous membrane.*

The troches of cubeb are extensively used for *coughs, hoarseness*, etc. The oil of cubeb is used as an inhalant and as a local application in many diseases of the *throat* and *respiratory passages.*

Internally.—Cubeb is used internally for about the same purposes as copaiba, although by many physicians considered to be inferior to the latter drug in genito-urinary disorders.

The drug has been recommended in certain nervous disorders, such as *headache, impaired memory, vertigo*, and *fainting*, and has even been thought to prove beneficial in certain cases of *paralysis.*

Contraindications.—The same as for copaiba.

Administration.—Any of the preparations may be given. The oleoresin is best administered in capsules or emulsion.

Diurētin—Diurētin—Diuretin.

(SODIO-SALICYLATE OF THEOBROMINE.)

Origin.—The name indicates the origin, the drug being a chemical combination of Theobromine (49.7 per cent.) and Salicylic Acid (38.1 per cent.). It is, in reality, a mixture of Theobromine and Sodium Salicylate.

Description and Properties.—A white powder, soluble in less than half its weight of hot water, the solution remaining perfect on cooling. Sparingly soluble in cold water; soluble in warm alcohol; insoluble in chloroform or ether. The drug has a disagreeable, soap-like taste, and undergoes decomposition when exposed to the air.

Dose.—15 grains (1.0 Gm.); 45 to 105 grains (2.9–7.0 Gm.) may be given in divided portions in twenty-four hours.

Antagonists and Incompatibles.—The properties of diuretin being as yet imperfectly known, it is impossible to enumerate all the antagonists, incompatibles, and synergists. The action of the drug would certainly be retarded by the cardiac and motor depressants. Acids, both mineral and vegetable, are incompatible.

Synergists.—The therapeutic influence of the drug would theoretically be enhanced by caffeine, digitalis, and many of the cardiac stimulants and diuretics.

Physiological Action.—*Externally and Locally.*—There is none.

Internally.—Digestive System.—Diuretin has no important action, though in many cases it may cause disturbance of digestion, impair the appetite, and even occasion nausea, vomiting, and diarrhea.

Circulatory System.—The drug has a very beneficial action upon the system in failing compensation and edema, its favorable influence being due to its effect upon the kidneys. Theobromine, like caffeine, exercises a direct, stimulating action upon the renal epithelium and also a stimulating effect upon the vaso-motor center in the medulla. While we should expect a marked diuretic action from the drug, such is not always the case, because of its vaso-motor influence in contracting the vessels of the kidney. The vaso-motor action, however, is remedied by the presence of the salicylate, leaving the blood-supply to the kidney increased, through the functional activity of the cells.

Nervous System.—Large and continued doses frequently occasion headache, somnolence or insomnia, with buzzing in the ears, and symptoms resembling those produced by the salicylates.

Respiratory System.—Diuretin exerts no direct influence upon the respiratory system. Yet dyspnea, bronchitis, etc., the result of a dropsical condition, are relieved by the administration of the drug.

Absorption and Elimination.—Diuretin is somewhat rapidly absorbed, being eliminated mainly by the kidneys, the process greatly stimulating the renal epithelium. It is proper to state, however, that some authors attribute the diuretic power of the drug to its action upon the circulation, rather than to any effect upon the secreting structures of the kidney. The author's experience leads him to incline to the opinion that the principal action of the drug is upon the kidneys.

In cases where diuretin is indicated the amount of urine is increased from three- to sixfold in twenty-four hours, under its administration the diuretic action of the drug gradually reaching its maximum between the second and third days. In the case of healthy persons diuretin has little influence upon the amount of urine excreted.

Untoward Action.—In certain individuals the drug causes great disturbance of the gastro-intestinal tract, such as nausea, vomiting, diarrhea, palpitation of the heart, headache, and slight fever; occasionally cutaneous eruptions may be present.

Poisoning.—No cases of poisoning are recorded.

Therapeutics.—The drug is used exclusively as a diuretic in cases of *dropsy, ascites, pleuritic effusion*, etc.

Diuretin is worthy of a thorough trial for the removal of *dropsical fluids*, irrespective of the cause.

Dr. Herrick of Chicago, who has not only devoted much study to the literature of the subject, but has also had a wide experience with the remedy, in a recent paper on "Diuretin" sums up the medical uses of the drug as follows:

"Diuretin is a diuretic acting by direct stimulation of the renal epithelium, and best suited to cases in which there is *general dropsical effusion.* It is the best medicinal remedy for removing dropsical fluid due to *valvular disease of the heart* after digitalis and pure cardiac tonics have failed. Diuretin has oftentimes a beneficial effect in other circulatory diseases with dropsy, as *myocarditis, pericarditis, aneurysm, arterio-sclerosis.* Its action is here more uncertain than in valvular disease. In the *dropsy of nephritis* it can be used without danger of irritating the kidney, the effects in *acute nephritis* being more certain than in chronic nephritis. Where the renal epithelium has undergone too extensive degeneration the drug may fail to act. In the *dropsy of portal obstruction,* and especially of *cirrhosis of the liver,* it usually fails to give good results."

Contraindications.—There are no special contraindications to the use of diuretin, unless it be in cases of marked gastric irritation, when the drug would undoubtedly aggravate the symptoms.

Administration.—Diuretin may be given in capsules or dissolved in some aromatic water or in milk. It should never be dispensed in powders, since it absorbs carbonic acid from the air and undergoes decomposition.

It is preferable to give the drug in solution; and it can be easily associated with digitalis and similar remedies, but when used with the cardiac remedies the doses of diuretin should be smaller.

When giving this drug in cases of marked ascites, or for the removal of large quantities of dropsical fluid, the first doses should be small and gradually increased to the maximum amount or until the desired effect be produced, lest by a too sudden removal of the fluid alarming collapse ensue.

As acids are incompatible with the drug, diuretin should not be given immediately after meals, but its administration postponed for about three hours, to avoid unpleasant symptoms arising from the action of the gastric juice upon the remedy.

The practice of adding fruit syrups or juices to a solution of diuretin for the purpose of rendering it more palatable should be strictly avoided, since the theobromine is precipitated by the vegetable acids as a thick white sediment.

The maximum daily amount which can be safely administered is 150 grains (9.72 Gm.). The average daily amount is 45 to 105 grains (2.9–7.0 Gm.), given in divided doses of about 15 grains (1.0 Gm.) each.

If diuresis is not increased in six days, the use of the drug should be suspended and recourse to other treatment adopted.

Piperazīnum—Piperazīni—Piperazin.

(PIPERAZIDINE; ETHYLENEIMINE; DIETHYLENEDIAMINE; DISPERMINE.)

Origin.—Obtained by the action of Ammonia on Bromide or Chloride of Ethylene.

Description and Properties.—It occurs as a crystalline solid, exceedingly soluble in water, the solution being practically tasteless. When exposed to the air the drug is very deliquescent, becoming completely liquefied on long exposure.

Dose.—5–15 grains (0.3–1.0 Gm.).

Antagonists and Incompatibles.—The incompatibles are alkaloids, tannic acid, preparations of cinchona, salts of iron, alum, Donovan's solution, acetanilid, phenacetine, and sodium salicylate.

Synergists.—Lithium and its salts and the lithontriptics enhance the therapeutic action of piperazin.

Physiological Action and Therapeutics.—The drug apparently has no effect whatever upon either the Digestive, Circulatory, or Respiratory Systems. Excessive doses, however, have affected the Nervous System, producing certain untoward manifestations, such as muscular tremors, hallucinations, and clonic spasms.

The drug is non-irritating when applied to mucous membranes.

Piperazin is rapidly absorbed from the stomach, circulates in the blood unchanged, and reaches the concretions of urates and gouty deposits, neutralizing and dissolving them, thus hastening their removal from the body. Piperazin may be detected in the urine two hours after ingestion.

The only important action of piperazin is its property of dissolving uric acid, with which it forms a neutral and exceedingly soluble salt, piperazin urate, said to be seven times more soluble in water than lithium urate.

The superiority of piperazin over lithium carbonate as a uric-acid solvent has been indubitably established.

Under the administration of piperazin there is an enormous increase in the amount of urea, with a corresponding decrease in the elimination of uric acid, indicating that there is active oxidation.

While greatly increasing the amount of urea eliminated, neither the volume of urine nor the acid reaction of that fluid is ordinarily influenced. Moreover, while in certain cases diuresis is considerably augmented, the specific gravity of the urine is lowered, although the urine never becomes alkaline or even neutral.

Therapeutics.—*Externally and Locally.*—A solution of piperazin (1 to 2 per cent.) in a mixture of water and alcohol (1 to 4, respectively) has been applied locally to *gouty joints* and *swellings* with beneficial results. A similar solution is equally effective in relieving the pain, allaying the inflammation, and hastening the healing of *gouty sores.*

Solutions of piperazin may be injected into the bladder in order to dissolve *vesical calculi.*

The drug has been recommended for local hypodermic injection in *gout,* although Wittsock, who used it in this manner considerably, claims that the subcutaneous administration of piperazin is painful and dangerous, causing inflammation with tendency to abscess.

Internally.—Piperazin is one of the most useful remedies in *gout.* Its efficacy in this disease is said to be enhanced by combining with it phenocoll hydrochloride or phenacetin.

Renal and *vesical calculi* of the uric-acid variety are dissolved by the free administration of piperazin. It has even proved beneficial in *chronic cystitis* and *chronic rheumatic arthritis.*

Gruber has advocated the use of the drug in *diabetes mellitus,* and it has proved to be of service in *renal colic* and *hematuria.*

It is in the uric-acid diathesis, however, that the drug is particularly useful. The *pruritus* of this condition and other manifestations so frequently resulting from imperfect elimination of nitrogenous material are promptly relieved by the internal administration of this remedy.

Contraindications.—None of importance can be named.

Administration.—Piperazin is best given in aërated water, although it may be acceptably administered in distilled water and syrup, orange flower water, or other agreeable vehicle.

Saccharīnum—Saccharīni—Saccharin.

(ANHYDRO-ORTHO-SULPHAMIN-BENZOIC ACID; BENZOYL-SULPHONIC-IMIDE; GLUSIDE; GLUCUSIMIDE.)

Origin.—A derivative of the aromatic series, prepared by a complicated process from Toluene.

Description and Properties.—A white, crystalline powder, of an acid reaction, a faint, amygdaloid odor, and an intensely sweet taste. One part of saccharin in 70,000 parts of water will impart to the solution a decidedly saccharine flavor, the drug being nearly 300 times sweeter than cane-sugar.

Saccharin is slightly soluble in water, 1 : 400; soluble in 30 parts of alcohol; and freely soluble in glycerin. The commercial article is usually very impure.

Dose.—½–2 grains (0.03–0.12 Gm.).

Physiological Action.—In a neutral or alkaline medium saccharin acts as an antiseptic. Internally it exerts no notable influence. It is said that when mixed with food it interferes with the action of saliva upon starch, and it is thought to retard the action of the other digestive ferments. The drug is not decomposed in the body, and is eliminated by the kidneys unchanged, increasing the amount of chlorides excreted in the urine, which fluid is so influenced by the drug that it does not so readily undergo fermentation.

Therapeutics.—*Externally and Locally.*—Saccharin is used as a mouth-wash, being especially beneficial in *aphthæ*. Felici of Rome highly recommends the application of a solution of saccharin in *ozena*.

Internally.—The principal use of the drug is as a substitute for sugar in cases of *diabetes*.

Dr. James Little recommends saccharin in *chronic cystitis* with ammoniacal urine.

The drug is extensively used in various elixirs, syrups, etc. to overcome the bitterness of quinine and other bitter alkaloids.

Administration.—Saccharin should be given in solution, or in tablets which may be dissolved singly in a cup of coffee.

GROUP XIV.—CATHARTICS.

CATHARTICS or PURGATIVES are substances which cause hurried evacuation of the bowels either by direct local irritation of the intestinal mucous membrane or by setting up an osmotic current from the tissues toward the lumen of the intestines, causing an accumulation of fluid in the bowels—in both cases causing increased peristalsis and watery or semisolid evacuations.

Mechanism of Purgation.—It should be remembered that the epithelial surfaces through which the substances needful to the body enter it, and the waste-products leave it, are physiologically outside the body. The mucous membrane of the alimentary canal is in a sense as much external as the skin covering the surface of the body and is subject to the same irritating influences. The muscular mechanism of the intestines is somewhat peculiar in that it possesses the power to rhythmically contract and relax in a wave-like manner (peristalsis), the peristaltic waves travelling downward. These rhythmical movements of the intestines carry their contents along their lumen from the cardia to the rectum, and are to a large extent independent of the central nervous system, although in a way controlled by a nervous mechanism. The normal contents of the small intestine are fluid, and are passed into the large intestine as such. In their passage along the large bowel the fluid part is largely absorbed and the semisolid part remaining is passed on into the rectum as feces.

In order that any substance may act as a purgative it must change the normal contents of the bowels in such a way as to cause fluid or semisolid evacuations. When a substance locally irritates the intestinal mucous membrane the intestines respond by increased peristalsis, which hurries the fluid contents of the small intestine through the large bowel so rapidly that absorption does not take place and the feces are evacuated in a fluid form.

While increased peristalsis may be caused by action on the nervous mechanism of the intestines, the exact *modus operandi* is imperfectly understood, and until the action of drugs on such mechanism is more thoroughly investigated we must assume that the action of purgatives is due chiefly to their local influence.

Cathartics may be classified according to their various actions, the following table serving to show how and where the various drugs exert their several influences:

1. Classification according to their Mode of Action.

Laxatives.

Cassia.
Castor oil.
Cascara sagrada.
* Glycerin.
* Magnesia.
* Magnesium carbonate.
Manna.
Sulphur.
Taraxacum.

There are certain drugs which are not classed as cathartics, which are sometimes prescribed by physicians as laxatives, such as—

Belladonna.*
Ergot.*
Hyoscyamus.*
Nux vomica.*
Physostigma.*
Stramonium.*

Certain articles of diet are laxative, such as bran biscuit, brown bread, gingerbread, oatmeal, figs, honey, molasses, prunes, raspberries, strawberries, tamarinds, olive oil, etc.

Simple purgatives.

Aloes.
Calomel.*
Cascara sagrada (full doses).
Castor oil (full doses).
Ox-gall.
Rhubarb.
Euonymus.
Iris.
Juglans.
Leptandra.
Senna.

Hydragogue purgatives.

Croton oil (small doses).
Elaterin.
Gamboge.

Salines.

Magnesium citrate.
Magnesium sulphate.
Potassium bitartrate.*
Potassium sulphate.
Potassium tartrate.*
Potassium and sodium tartrate.
Sodium phosphate.
Sodium sulphate.

Drastic purgatives.

Cathartic acid (hypodermically).
Colocynth.
Croton oil.
Elaterin.
Gamboge.
Jalap.
Scammony.
Podophyllin

2. Classification according to their Manner of reaching the Intestinal Mechanism.

By first contact.

Nearly all the drugs used as cathartics.

By circulation contact.

Morphine.*
Muscarine.*
Physostigma.*
Pilocarpine.*
Strychnine.*

By excretion contact.

Aloes.
Castor oil.
Croton oil.
Colocynth.
Elaterium.
Podophyllin.
Rhubarb.
Senna.

3. Conditions of the Intestines affecting the Action of Drugs.

Drugs requiring the presence of an alkali or bile to act.	Drugs requiring the presence of an acid to act.	Drugs not requiring the presence of either alkali, bile, or acid.
Aloes.	Magnesium carbonate.*	Castor oil.
Elaterium.	Magnesia.*	Colocynth.
Gamboge.		Croton oil.
Jalap.		Euonymin.

(Drugs marked with an asterisk (*) are here given in detail; others are described elsewhere.)

Drugs requiring the presence of an alkali or bile to act.	Drugs not requiring the presence of either alkali, bile, or acid.
Scammony.	Iris.
Sulphur.	Leptandra.
	Magnesium citrate.
	Magnesium sulphate.
	Podophyllin.
	Potassium and sodium tartrate.
	Rhubarb.
	Senna.
	Sodium phosphate.

4. Classification according to the Anatomical Portion of the Intestinal Canal on which they Act.

Small intestine.	Colon.	Descending colon and rectum.
Calomel.*	Colocynth.	Aloes.
Castor oil.	Elaterium.	
Jalap.	Gamboge.	
Leptandra.	Magnesium citrate.	
Podophyllin.	Magnesium sulphate.	
Rhubarb.	Potassium bitartrate.*	
Scammony.	Potassium sulphate.	
Senna.	Potassium tartrate.*	
	Potassium and sodium tartrate.	
	Sodium sulphate.	

5. Classification of Cathartics according to Other Actions.

Stomachics.	Hepatic stimulants and cholagogues	Galactagogues.	Rendering the milk purgative.	Increasing menstrual flow.
Aloes.	Aloes.	Castor oil.	Aloes.	Aloes.
Cascara sagrada.	Colocynth.		Castor oil.	
Euonymin.	Colchicin.		Rhubarb.	
Leptandrin.	Euonymin.		Senna.	
Iridin.	Iridin.		There are probably some other cathartics that affect the milk.	
Rhubarb.	Leptandrin.			
	Podophyllin.			
	Sodium phosphate.			
	Sodium sulphate.			

Cholagogues.	
Aloes.	Mercury with chalk.*
Calomel.*	Pil. hydrargyri.*
Colocynth.	Podophyllin.
Euonymin.	Rhubarb.
Iridin.	

(Drugs marked with an asterisk (*) are here given in detail; others are described elsewhere.)

Intestinal peristalsis is increased probably by the stimulation of—

1. The intestinal muscles (moderate stimulation);
2. The afferent nerves connecting the intestinal mucous membrane with Auerbach's ganglia;
3. Auerbach's ganglia;
4. The ends of the efferent nerves passing from Auerbach's ganglia to the intestinal muscles;
5. The ends of the afferent nerves passing from the intestinal mucous membrane to the brain;
6. The motor centers in the brain;
7. The ends of the motor nerves terminating in Auerbach's ganglia.

Depression of—

8. The inhibitory motor center;
9. The ends of the inhibitory motor nerves terminating in Auerbach's ganglia;
10. The inhibitory motor center in the suprarenal plexus.

It will be seen that any substance which stimulates the motor apparatus or depresses the inhibitory motor mechanism will increase peristalsis.

Intestinal secretion may doubtless be promoted by any substance which serves to stimulate the secretory or the vaso-dilator apparatus, or to depress the inhibitory secretory or vaso-constrictor mechanism.

The methods by which absorption is diminished are not thoroughly understood, but it is known that—

1. By increasing peristalsis and hastening the removal of fluid from the bowels absorption takes place less rapidly;
2. By giving drugs—*e. g.* magnesium sulphate—having high osmotic equivalents, with a great affinity for water, the absorption of fluid is prevented;
3. Substances which in some manner affect the columnar epithelium of the intestinal glands retard absorption;
4. Drugs which diminish the circulation in the intestinal mucous membranes act as deterrents to the absorptive process.

It is apparent that certain drugs produce various effects, and that their mode of action varies according to the size of the dose and occasionally with the idiosyncrasy of the patient.

Nearly all cathartic drugs act by some local influence upon the

intestinal mucous membranes previous to absorption; others, again, affect the bowels after they have entered the circulation—strychnine, for example, physostigmine, pilocarpine, etc., acting in this manner.

Certain other drugs, such as podophyllin, colocynth, etc., if injected into the circulation are excreted by the mucous membrane of the intestines, and by their irritation produce catharsis.

The condition of the intestinal canal has much to do with the activity of certain drugs. Thus certain medicines produce catharsis regardless of the reaction of intestinal fluids; others are inert without the presence of bile or other alkaline fluids or salts; and still a third class occasion catharsis only when after ingestion they come in contact with an acid. Of the last mentioned, magnesium carbonate is an excellent example, the drug being inert unless it be acted upon by an acid in the stomach or bowels.

It is a remarkable fact that, as is shown in the tables, different cathartics act more energetically upon different portions of the intestines. The action of calomel, for instance, is almost entirely confined to the duodenum, while aloes acts only upon the descending colon and the rectum.

In selecting a cathartic, therefore, a knowledge of the part of the intestinal canal to be acted upon and the locality in which the drug operates is necessary in order to secure the most satisfactory results.

Many cathartics contain principles which render them tonic to the stomach; others greatly stimulate the secretion of bile (hepatic stimulants); while the cholagogues merely hasten the expulsion of bile from the intestinal canal, preventing its absorption.

Certain drugs, being excreted in the milk, which it renders purgative, are well adapted for administration to the nursing mother in order to produce catharsis in the infant. Castor oil, greatly augmenting the secretion of milk, is an excellent medium as a laxative in such cases.

Aloes increases the menstrual flow; other drugs promote the secretion of urine, etc.

Therapeutics.—Cathartics are employed—

1. *To remove feces and produce a simple evacuation of the bowels.* The Laxatives are best adapted for this purpose.

2. *For the relief of chronic constipation.* For this purpose great judgment is requisite in the selection of a drug or combination of agents, it being important to determine whether there is diminished peristalsis or secretion; whether there exists an atonic condition of

the intestinal muscles; or whether the disorder is located in the small intestine, the colon, or the rectum.

3. *To remove from the bowels noxious substances or pathogenic matter.* For this purpose the mercurial preparations, calomel or gray powder, are best, since they are not only active cathartics, but bactericides as well.

4. *To stimulate the torpid liver.* For this purpose the hepatic stimulants would naturally be employed.

5. *To lessen the activity of the liver*, as in bilious conditions. In such cases the cholagogue cathartics should be used.

6. *To deplete the gastro-duodenal mucous membrane*, where the congested and swollen mucous membrane obstructs the outflow of bile, resulting in jaundice. In this condition the salines, especially the sodium salts, are the most efficient cathartics.

7. *To promote absorption and remove dropsical effusions* in certain diseases of the heart, liver, and kidneys. Here active catharsis is necessary, the hydragogue cathartics being indicated.

8. *To remove urea, etc., from the blood.* Occasionally in certain renal diseases the functional activity of the kidneys is so defective that waste matter, urea, etc., rapidly accumulates in the system, occasioning uremic convulsions, coma, or other serious symptoms. In such cases it may be necessary to give a drastic purgative, such as croton oil, which acts rapidly, causing profuse watery stools.

9. *To lower the blood-pressure* where high arterial tension aggravates a malady, as at the onset of many acute diseases, and in cerebral hemorrhage, meningitis, etc. In these conditions it is necessary to employ such drugs as, by dilating the intestinal blood-vessels, drain the blood away from other organs and cause abundant watery discharges from the bowels. Hydragogue or drastic purgatives answer the required purpose.

10. *For the relief of hemorrhoids*, in which cases the mild laxatives, such as sulphur, senna, etc., are serviceable.

11. *To aid the restoration of the catamenia.* For this purpose aloes is usually employed, particularly if it be necessary to determine more blood to the pelvic organs. If depletion be required, the selection should be made from the hydragogue cathartics.

12. *To purge the nursing infant through the mother's milk.* For this purpose such drugs as rhubarb, senna, and castor oil may be administered to the mother.

13. *To lower the temperature in fever*, in which cases the saline cathartics may be advantageously employed.

Contraindications.—Active catharsis by the more powerful hydragogue or drastic purgatives would be contraindicated in appendicitis, peritonitis, typhlitis, intussusception, pregnancy, and typhoid fever, or where there is inflammation of the mucous membrane of the gastro-intestinal tract.

Administration.—Probably no group of medicines demands greater judgment in administration than Cathartics.

Ordinarily, the efficiency of these agents is increased and their operation rendered less irritant by associating drugs acting upon different portions of the alimentary canal. Their action, too, is more prompt and certain when the remedies are given upon an empty stomach and the efficiency of their operation is enhanced by exercise and diminished by sleep.

The action of cathartics is promoted by the addition of small doses of emetics, mydriatics, quinine, and bitters, quinine especially strengthening the action of magnesium sulphate. Mild diluent beverages also promote the activity of cathartics. Cold applied to the abdomen, enemata, massage of the abdominal walls, and electricity, all act as adjuvant measures in the employment of purgative medicines.

As has been previously suggested, a knowledge of the portion of the intestinal canal upon which the various cathartics act is of primary importance. Thus, if it be necessary to influence only the duodenum, calomel or podophyllin should be used; if the small intestine, senna or jalap; if the descending colon or rectum, aloes,—the drugs acting upon these organs alone.

Moreover, due consideration should be given to the proper time for the administration of the different cathartics, the resinoid purgatives acting best when taken at night or before dinner, and the salines when taken in the morning before breakfast.

The mode of administration is also of great importance, in order to obtain from these agents the fullest benefit. The salines, for instance, act best when given in solution in either very cold or very hot water, their activity being enhanced by association with bitters, iron, or sulphuric acid. On the other hand, the resinoid drugs should be administered in the form of pills, and if, for any reason, it is desirable that the drug should enter the intestine without coming in contact with the mucous membrane of the stomach, the drug may be given in the form of pills coated with keratin, which is unaffected by the gastric juice, but readily dissolved in the alkaline intestinal juices.

In the following detailed description cathartic drugs are grouped according to their *modus operandi*, the mildest drugs or laxatives being first considered.

LAXATIVES.

Certain substances never produce active purgation, but simply unload the bowels by slightly increasing both peristalsis and secretion, expelling the feces in a softened though solid and formed condition, without irritation and without perceptibly affecting the general system.

These agents are especially useful where we wish to evacuate the bowels with the least possible local derangement, as in simple constipation from dyspepsia, in children, pregnant women, convalescents from acute disease, or patients affected with hemorrhoids, hernia, affections of the rectum or womb, typhoid fever, early simple diarrhea, or in inflammation or surgical operations about the abdomen and pelvis.

Besides the laxative drugs mentioned below there are many articles of diet which by purely mechanical action produce catharsis, such as oatmeal, brown bread, whole flour, molasses, prunes, figs, etc.

Cassia Fistula—Cassiæ Fistulæ—Cassia Fistula. *U. S. P.*

(PURGING CASSIA.)

Origin.—The fruit of *Cassia Fistula* L., a tree 30 to 50 feet (9–15 M.) high, indigenous in the East Indies.

Description and Properties.—Cylindrical, 1½ to 2 feet (45–60 Cm.) long, nearly 1 inch (25 Mm.) in diameter, blackish-brown, somewhat veined, the sutures smooth, forming two longitudinal bands; indehiscent, internally divided transversely into numerous cells, each containing a reddish-brown, glossy, flattish-ovate seed imbedded in a blackish-brown sweet pulp; odor resembling that of prunes.

Dose.—1–2 drachms (4.0–8.0 Gm.).

Official Preparation.

Confectio Sennæ—Confectionis Sennæ—Confection of Senna.—Described under Senna, p. 681.

Physiological Action and Therapeutics.—Cassia is a mild and pleasant laxative. It is seldom given alone, however, but forms an ingredient in the confection of senna.

Oleum Ricīni—Olei Ricīni—Castor Oil. *U. S. P.*

Origin.—A fixed oil expressed from the seed of *Ricinus communis* L., a plant indigenous in Southern Asia and cultivated in temperate countries for ornament and other purposes, remaining a large annual.

Description and Properties.—A pale-yellowish or almost colorless, transparent, viscid liquid, having a faint, mild odor and a bland, afterward slightly acrid and generally offensive taste. Soluble in an equal volume of alcohol and in all proportions in absolute alcohol. Castor oil should be kept in well-stoppered bottles.

Dose.—¼–2 fluidounces (8.0–60. Cc.)

Physiological Action.—*Externally and Locally.*—Castor oil—like other bland fixed oils, such as almond oil, olive oil, etc.—is sedative and protective when applied to the skin or mucous membranes.

Internally.—The only important action is upon the intestinal tract, on which the oil acts as a mild irritant, causing purgation. Chemically castor oil is a combination of glycerin, fatty acids, and ricinoleic acid. This combination passes the stomach unchanged, but in the presence of the bile and pancreatic juice it is broken up into glycerin and ricinoleic acid; the ricinoleic acid combines with sodium and forms sodium ricinoleate, which has marked irritating properties. The ricinoleate of sodium is absorbed and excreted in various ways, appearing in the mother's milk and imparting to it purgative properties.

Castor oil requires from four to six hours to operate, its action being usually attended with little pain. Indeed, the author is inclined to attribute anodyne properties to the drug, since it has frequently occurred to him in practice that a dose of castor oil given to a child suffering with colicky pains, while producing no movement of the bowels, served to allay the distress and cause the patient to sink into a quiet sleep.

The poisonous principle, ricin, found in castor beans is an albuminous substance belonging to the globulin group, and is generally termed a toxglobulin. Ricin is one of the most powerful poisons known, but being insoluble in oil and soluble in water it is not present in expressed castor oil. The symptoms of poisoning from castor beans are violent abdominal pain, vomiting, purging, and collapse. *Post-mortem* examinations have revealed evidences of severe inflammation in the stomach and intestines.

Castor oil should not be used as an habitual laxative, its continual employment being liable to occasion constipation with all its attendant evils.

Therapeutics.—Castor oil is used alone or associated with balsam of Peru as a sedative protectant dressing for *superficial ulcerations*. The drug is also serviceable in various diseases of the skin and mouth.

It is probably superior to all other laxatives, and is applicable to all conditions for which laxatives are employed. In large doses it is one of the best purgatives to give in conjunction with an anthelmintic.

Administration.—The unpleasant taste of castor oil is the only objection to its use. Yet it can be rendered quite palatable by mixing it with an equal quantity of glycerin, to which may be added a few drops of oil of cinnamon or oil of wintergreen.

Various other devices for disguising the taste have been adopted, such as enveloping the oil in the froth of beer, ale, or porter, or washing out the mouth with brandy or whiskey previous to administration, and allowing the patient to swallow the oil quickly, when it will not adhere to the mouth and fauces, especially if followed by a drink of some alcoholic liquid.

In the form of an emulsion the taste of the oil is well disguised. There are also soft capsules of castor oil which are of course tasteless, yet they are too bulky to be popular.

Castor-oil emulsion may be used as an enema when a mild injection is required.

Rhămnus Purshiāna—Rhămni Purshiānæ—Cascara Sagrada. *U. S. P.*

Origin.—The bark of *Rhamnus Purshiana* D. C., a shrub or small tree 15 to 20 feet (4.5–6 M.) high, indigenous on the Pacific coast of North America from the British possessions southward to Northern California.

Description and Properties.—Quills or curved pieces about $\frac{1}{4}$ to 4 inches (3–10 Cm.) long and about $\frac{1}{12}$ inch (2 Mm.) thick; outer surface brownish-gray and whitish, the young bark with numerous, rather broad, pale-colored warts; inner surface yellowish to light brownish, becoming dark brown with age; smooth or finely striate, fracture short, yellowish, in the inner layer of thick bark somewhat fibrous; inodorous; taste bitter.

The bark contains red, yellow, and brown resins, tannic, malic,

and oxalic acids, a volatile oil, and a neutral, crystalline substance.

Dose.—30–60 grains (2.0–4.0 Gm.).

Official Preparation.

Extractum Rhamni Purshianæ Fluidum—Extracti Rhamni Purshianæ Fluidi—Fluid Extract of Rhamnus Purshiana.—*Dose*, ½–1 fluidrachm (1.0–4.0 Cc.).

Unofficial Preparations.

Certain pharmaceutical chemists, in order to overcome the bitter taste of cascara, have devised various preparations, such as—

Cascara Cordial.

Aromatic Fluid Extract of Cascara.

Elixir of Cascara, etc.

Physiological Action.—Cascara sagrada is a peculiarly efficient laxative, although in certain individuals it appears to be inert unless associated with other purgatives. The bitter principle it contains gives to the drug stomachic properties, and it is also said to stimulate slightly the functional activity of the liver.

The action of cascara is seldom attended with irritation or unpleasant symptoms, the drug requiring from six to ten hours to operate.

Therapeutics.—Cascara is a very valuable laxative, being employed chiefly to overcome *habitual constipation* due to simple torpor of the colon without associated disease. The drug is not adapted for rapid evacuation of the bowels, but rather for regulating their action.

Administration.—The fluid and solid extracts are usually employed, although the cascara cordial and the aromatic fluid extract, while requiring larger doses, are so palatable that they have become deservedly popular.

Whatever be the preparation used in cases of habitual constipation, it should be given in small but repeated doses, gradually diminished until a natural action of the bowels shall have been established. The drug should be administered upon an empty stomach and in as diluted a condition as possible.

Magnēsia—Magnēsiæ—Magnesia. *U. S. P.*

(Light Magnesia; Calcined Magnesia.)

Origin, description, and properties given under "Alkalies," p. 156.

Dose.—5–60 grains (0.32–4.0 Gm.).

Magnēsii Carbōnas—Magnēsii Carbonātis—Magnesium Carbonate. *U. S. P.*

Origin, description, and properties given under "Alkalies," p. 156.

Dose.—¼–2 drachms (1.0–8.0 Gm.).

Physiological Action.—Both magnesia and magnesium carbonate are mild antacid laxatives, requiring the presence of an acid in the stomach and bowels to render them active. Occasionally, when there is marked acidity of the stomach, magnesium carbonate occasions flatulence.

When taken in large amounts or for a long time magnesia tends to accumulate in the intestines. This untoward effect may be prevented by administering with the drug lemonade, the acid of which increases the solubility of the magnesia.

Therapeutics.—MAGNESIUM CARBONATE as a protective powder is an effective agent in the treatment of *dermatitis of the external auditory passage*. The drug is a valuable antidote to counteract the effects of *phosphorus-poisoning* in the throat.

Both MAGNESIA and MAGNESIUM CARBONATE are mild alkalies, and may be used for the same purposes as the alkalies. They are serviceable antidotes to *poisoning* from mineral and oxalic acids and many mineral salts. They are pleasant laxatives, being extensively employed for children.

Mănna—Mănnæ—Manna. *U. S. P.*

Origin.—The concrete, saccharine exudation of *Fraxinus Ornus* L., a slender tree indigenous on the northern shore of the Mediterranean from Asia Minor west to Spain.

Description and Properties.—Flattish, somewhat three-edged pieces, about 8 inches (20 Cm.) long and 2 inches (5 Cm.) broad (usually smaller), friable, externally yellowish-white, internally white, porous, and crystalline; or fragments of different sizes, brownish-white and somewhat glutinous on the surface, internally white and crystalline; odor honey-like; taste sweet, slightly bitter, and faintly acrid. Manna contains a resin, the purgative principle, besides mannite, fraxin, and sugar.

Dose.—½–1 ounce (16.0–32.0 Gm.), dissolved in hot water.

Official Preparation.

Infūsum Sĕnnæ Compŏsitum—Infūsi Sĕnnæ Compŏsiti—Compound Infusion of Senna.—See Senna, p. 681.

Physiological Action and Therapeutics.—Manna is a laxative, cholagogue, and nutrient. Its mild laxative action renders the drug peculiarly efficient in *constipated conditions* of pregnant women, and children and persons suffering from *piles* or *irritation of the genito-urinary tract.*

The drug is slow in its action, tending to confine the bowels after the primary laxative effect.

Sŭlphur Sublimātum—Sŭlphuris Sublimāti—Sublimed Sulphur. *U. S. P.*

Origin.—Obtained from Crude Sulphur by sublimation.

Description and Properties.—A fine yellow powder, having a slight characteristic odor and a faintly acid taste. Insoluble in water; slightly soluble in absolute alcohol; more readily soluble in benzin, benzol, oil of turpentine and many other oils, as well as in ether, chloroform, and boiling aqueous solutions of alkaline hydrates.

Dose.—15–60 grains (1.0–4.0 Gm.).

Official Preparations.

Sŭlphur Lōtum—Sŭlphuris Lōti—Washed Sulphur.—*Origin.*—Sublimed Sulphur, 100; Water, 100; Ammonia Water, 10; digested, filtered, drained, and dried.

Description and Properties.—A fine yellow powder without odor or taste. Insoluble in water, but soluble in the substances which dissolve sulphur.

Dose.—15–60 grains (1.0–4.0 Gm.).

Unguĕntum Sŭlphuris—Unguĕnti Sŭlphuris—Sulphur Ointment.—Washed Sulphur, 300; Benzoinated Lard, 700. For external use.

Washed sulphur is an ingredient of compound liquorice powder.

Sŭlphur Præcipitātum—Sŭlphuris Præcipitāti—Precipitated Sulphur. *U. S. P.*

(Milk of Sulphur; Lac Sulphur.)

Origin.—Sublimed Sulphur is boiled with Slaked Lime and Water. To the solution is added Hydrochloric Acid, which throws down Sulphur as a fine precipitate, the powder being washed and dried.

Description and Properties.—A fine amorphous powder of a pale-yellow color, without odor or taste. Insoluble in water.

Dose.—15–60 grains (1.0–4.0 Gm.).

Physiological Action.—*Externally and Locally.*—Sulphur is an active parasiticide, antiseptic, and keratoplastic agent. Upon the skin the drug of itself has no influence; a portion of it, however,

is converted into hydrogen sulphide, which acts as a mild cutaneous irritant.

Internally.—As observed, sulphur proper has no action either externally or locally, although it is a normal constituent of nearly all the solids and fluids of the body. When ingested some of it is converted into hydrogen sulphide and other sulphides, which increase the intestinal secretions and promote peristalsis.

The drug is chiefly excreted with the stools, which are rendered soft and semi-liquid. A portion of the hydrogen sulphide formed is eliminated through the kidneys, lungs, skin, and milk-glands. The drug is usually found in the urine as sulphate.

There is imparted to the breath the offensive odor of hydrogen sulphide, and the minute portion eliminated through the skin is sufficient to discolor silver ornaments in contact with the body-surface.

While hydrogen sulphide is a powerful poison, decomposing the blood and paralyzing the nervous and muscular systems, the amount formed and absorbed under the administration of sulphur is too small to produce marked toxic symptoms, even when large amounts of sulphur have been ingested, there is produced only violent vomiting and purging, a slight elevation of temperature, and a distinct odor of hydrogen sulphide in the breath.

When sulphur is used in full doses for a long time, it tends to impair the quality of the blood and produce muscular weakness. Occasionally untoward manifestations, such as miliary eruption and eczema, accompany either the external application or the ingestion of the drug.

As a laxative sulphur is slow and mild, although it occasionally causes considerable flatus, in some cases rendering the drug objectionable as a purgative.

Therapeutics.—*Externally and Locally.*—While classed among laxative drugs, SULPHUR is a most efficient remedy in many diseases of the *skin*, *nose*, *throat*, etc., the external uses of sulphur being very numerous.

The drug is perhaps the most serviceable parasiticide we possess in *scabies*, SULPHUR OINTMENT well rubbed into the skin being usually sufficient to destroy the parasite.

Even diseases induced by vegetable parasites, such as *tinea versicolor*, etc., are cured by inunctions of SULPHUR OINTMENT.

The drug is successfully employed in the treatment of *infiltrated eczema*, *impetigo*, *sycosis*, *ecthyma*, *acne*, *comedo*, and *psoriasis*.

The FLOWERS OF SULPHUR is an old domestic remedy, and quite

an efficient one, in *diphtheria* and *pharyngitis*. Finally, Coroden and Duchane have both reported the successful treatment of *sciatica* by enveloping the affected limb in PRECIPITATED SULPHUR, the profuse sweating induced being followed by a decided alleviation of pain.

When SULPHUR is burned in moist air sulphur dioxide is formed, a powerful germicide. By the fumes rooms and clothing may be disinfected, fumigation by sulphur being a common procedure to destroy the germs of *typhoid fever*, *tuberculosis*, *cholera*, *diphtheria*, *small-pox*, etc., during which process, it may be noted, silver-ware should be removed to prevent discoloration.

Internally.—The principal internal use of SULPHUR is as a mild laxative, the drug being especially indicated for persons afflicted with *hemorrhoids* or *anal fissure*.

LOZENGES are prepared containing sulphur and cream of tartar, which, if taken daily for some time, will overcome *habitual constipation*, being especially serviceable in *constipation due to disease of the liver*.

SULPHUR has been used internally, and occasionally with considerable success, in *bronchitis*, *chronic rheumatism*, and *eczema* attended with much itching.

Administration.—Sulphur may be given in the form of lozenges or mixed with molasses—either alone or associated with cream of tartar, which is said to enhance the action of sulphur. Milk and syrup have been used as vehicles in the administration of the drug.

Sulphurous baths, both natural and artificial, have been employed in the treatment of *rheumatism*, *gout*, and some *cutaneous affections*. Not only for these purposes, but for their laxative influence as well, sulphurous waters are held in great repute.

Tarăxacum—Tarăxaci—Taraxacum. *U. S. P.*

(DANDELION.)

Origin.—The root of *Taraxacum officinale* Weber, a perennial, acaulescent herb found in most countries of the northern hemisphere.

Description and Properties.—Slightly conical, about 12 inches (30 Cm.) long and ½ to 1 inch (12–25 Mm.) thick above, crowned with several short, thickish heads, somewhat branched, dark brown, longitudinally wrinkled; when dry breaking with a short fracture, showing a yellowish, porous central axis surrounded by a thick,

white bark containing numerous milk-vessels arranged in concentric circles; inodorous; bitter.

The drug contains a bitter principle, *taraxacin*, besides *inulin*, resin, sugar, and mucilaginous substances.

Dose.—1–4 drachms (4.0–15.0 Gm.).

Official Preparations.

Extractum Taraxaci—Extracti Taraxaci—Extract of Taraxacum.—*Dose*, 5–60 grains (0.3–4.0 Gm.).

Extractum Taraxaci Fluidum—Extracti Taraxaci Fluidi—Fluid Extract of Taraxacum.—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Physiological Action and Therapeutics.—Taraxacum is a stomachic tonic, diuretic, laxative, cholagogue, and feeble hepatic stimulant. It has been a popular remedy for *constipation* associated with *hepatic congestion* and *atonic dyspepsia*, yet the drug is now less employed than formerly, in actual practice being usually united with other laxatives.

The extract or fluid extract may be given, the latter and the expressed juice being the more active.

SIMPLE PURGATIVES.

These differ from laxatives only in degree, the former being more active, exciting greater peristaltic action and causing a larger secretion from the intestinal glands. Simple purgatives usually occasion one or more copious and somewhat liquid stools, frequently accompanied by considerable irritation and griping.

Aloe—Aloes—Aloes. *U. S. P.*

Origin.—The inspissated juice of the leaves of *Aloe* (*A. vera* (L.) Webb; *A. Perryi* Baker), a plant resembling the so-called century plant (*Agave Americana*), indigenous in India and North-eastern Africa, and naturalized along the shores of the Mediterranean and in the West Indies.

Official Varieties.

Aloe Barbadensis—Aloes Barbadensis—Barbadoes Aloes (Curaçoa Aloes).—*Origin.*—Prepared from *Aloe vera.*

Habitat.—Island of Barbadoes.

Description and Properties.—Hard masses, orange-brown, opaque, translucent on the edges; fracture waxy or resinous, somewhat conchoidal; odor saffron-like; taste strongly bitter.

Dose.—½–10 grains (0.03–0.6 Gm.).

Ăloe Socotrīna—Aloes Socotrīnæ—Socotrine Aloes.—*Origin.*—Obtained from *Aloe Perryi.*

Habitat.—Island of Socotra in the Strait of Bab-el-Mandeb.

Description and Properties.—Hard masses, occasionally soft in the interior, opaque, yellowish-brown, orange-brown, or dark ruby-red, not greenish, translucent on the edges; fracture resinous, somewhat conchoidal. When breathed upon it emits a fragrant, saffron-like odor. Taste peculiar, strongly bitter. Almost entirely soluble in alcohol and in 4 parts of boiling water. The aqueous solution becomes turbid on cooling and yields a deposit. Examined under the microscope, Socotrine aloes exhibits numerous crystals.

The active principle of the various Aloes is *aloïn*, a neutral principle, varying in chemical composition and physical properties according to the species from which it is derived; thus the substance from Barbadoes aloes (barbaloïn) is soluble in 60 parts of water, 20 parts of alcohol, and 470 parts of ether; that from Socotrine aloes (socaloïn) is soluble in 60 parts of water, 30 parts of absolute alcohol, and 380 parts of ether.

Nataloïn, obtained from the unofficial Cape aloes, may be distinguished from the official aloïn by heating the former with a drop or two of sulphuric acid and exposing it to the vapor of nitric acid, when nataloïn changes to a blue color; barbaloïn and socaloïn are unaffected by this test. Nitric acid applied to barbaloïn gives a crimson color, which rapidly fades; the crimson color imparted to nataloïn is permanent, while no color is produced when nitric acid is applied to socaloïn.

Dose.—½–10 grains (0.03–0.6 Gm.).

Official Preparations.

Extrăctum Ăloes—Extrăcti Ăloes—Extract of Aloes.—*Dose*, ½–6 grains (0.03–0.4 Gm.).

Ăloe Purificāta—Ăloes Purificātæ—Purified Aloes.—*Dose*, ½–10 grains (0.03–0.6 Gm.).

Extrăctum Colocȳnthidis Compŏsitum—Extrăcti Colocȳnthidis Compŏsiti—Compound Extract of Colocynth.—*Dose*, 5–25 grains (0.3–1.6 Gm.).

The following official preparations are prepared from purified aloes:

Pĭlulæ Ăloes—Pĭlulas (acc.) **Ăloes—Pills of Aloes.**—*Dose*, 1 to 4 pills.

Pĭlulæ Ăloes et Asafœtidæ—Pĭlulas (acc.) **Ăloes et Asafœtidæ—Pills of Aloes and Asafetida.**—Each pill contains about 1½ grains (0.085 Gm.) of each.—*Dose*, 1 to 5 pills.

Pĭlulæ Ăloes et Fĕrri—Pĭlulas (acc.) **Ăloes et Fĕrri—Pills of Aloes and Iron.**—Each pill contains about 1 grain (0.06 Gm.), each, of Aloes, dried Ferrous Sulphate, and Aromatic Powder.—*Dose*, 1 to 4 pills.

Pĭlulæ Ăloes et Măstiches—Pĭlulas (acc.) **Ăloes et Măstiches—Pills of Aloes and Mastich.**—Each pill contains about 2 grains (0.12 Gm.), together with Mastich and Red Rose.—*Dose*, 1 to 3 pills.

Pĭlulæ Ăloes et Mȳrrhæ—Pĭlulas (acc.) **Ăloes et Mȳrrhæ—Pills of Aloes and Myrrh.**—Each pill contains 2 grains (0.12 Gm.), together with Myrrh and Aromatic Powder.—*Dose*, 1 to 3 pills.

Pĭlulæ Rhēi Compŏsitæ—Pĭlulas (acc.) **Rhēi Compŏsitas—Compound Pills of Rhubarb.**—Each pill contains 1 grain (0.06 Gm.) of Aloes.—*Dose*, 1 to 3 pills.

Tinctūra Ăloes—Tinctūræ Ăloes—Tincture of Aloes (10 per cent.).—*Dose*, ½–1 fluidrachm (2.0–4.0 Cc.).

Tinctūra Ăloes et Mўrrhæ—Tinctūræ Ăloes et Mўrrhæ—Tincture of Aloes and Myrrh (10 per cent. of each, with Glycerin 10 per cent.).—*Dose*, 1–2½ fluidrachms (2.0–10.0 Cc.).

Tinctūra Benzoīni Compŏsita—Tinctūræ Benzoīni Compŏsitæ—Compound Tincture of Benzoin (2 per cent. of Aloes).—*Dose*, 10–40 minims (0.6–2.6 Cc.).

Aloīnum—Aloīni—Aloin. U. S. P.—*Origin.*—A neutral principle obtained from several varieties of Aloes.

Description and Properties.—Minute, acicular crystals, or a micro-crystalline powder, varying in color from yellow to yellowish-brown; odorless or possessing a slight odor of aloes, of a characteristic, bitter taste, and permanent in the air. The solubilities of *barbaloīn* and *socaloīn* are given above.

Dose.—½–2 grains (0.03–0.12 Gm.).

Physiological Action.—Aloes has no local action, although the drug is readily absorbed from ulcers or abraded surfaces.

Internally, it is stomachic, increasing the secretions from the gastro-intestinal tract. It probably increases the secretion of bile. Its principal action appears to be upon the colon, the muscular coat of which it stimulates, besides augmenting the secretion from the large intestine.

In from ten to fifteen hours after the ingestion of the drug it causes soft, dark-colored evacuations, its action being usually attended with more or less griping pain.

The blood-supply to the lower bowel and pelvic viscera is increased by aloes; and the drug, if used habitually, may bring on or aggravate hemorrhoids. The menstrual function is stimulated, the drug being quite a decided emmenagogue.

Aloes is readily absorbed; it is thrown off through the bowels and kidneys, and is found also in the milk.

Therapeutics.—The principal use of ALOES is as a purgative in *habitual constipation* due to a torpid condition of the large intestine. *Jaundice* resulting from hepatic congestion is well treated with aloes and blue pill.

PILLS OF ALOES AND IRON are useful adjuvants to other remedies in the treatment of *chlorosis*. *Amenorrhea*, which is such a common condition in chlorosis, is relieved by aloes. Pills of aloes and iron are equally valuable in *menorrhagia* arising from debility.

Contraindications.—Aloes is ordinarily contraindicated in hemorrhoids, although those cases attended with a mucous discharge are frequently benefited by it. The drug is considered objection-

able in pregnancy, in persons of plethoric, bilious, or hemorrhagic constitution, and in menorrhagia of the strong and full-blooded.

Administration.—When desired as a purgative, aloes in pill form is preferable to the liquid preparations, and the drug may be given alone or associated with other purgatives, tonics, or antispasmodics.

Aloin is perhaps to be preferred to aloes, as it gripes less and may be given in smaller doses.

As a purgative aloes ranks between rhubarb and senna.

Fĕl Bōvis—Fĕllis Bōvis—Oxgall. *U. S. P.*

(Fel Tauri.)

Origin.—The fresh bile of *Bos Taurus* L.

Description and Properties.—A brownish-green or dark-green, somewhat viscid liquid, having a peculiar, unpleasant odor and a disagreeable, bitter taste.

Dose.—5–15 grains (0.3–1.0 Gm.).

Official Preparation.

Fĕl Bōvis Purificātŭm—Fĕllis Bōvis Purificāti—Purified Oxgall.—*Description and Properties.*—A yellowish-green, soft solid, having a peculiar odor and a partly sweet and partly bitter taste. Very soluble in water and in alcohol.

Dose.—5–15 grains (0.3–1.0 Gm.).

Physiological Action and Therapeutics.—Like bile, oxgall augments the duodenal secretions, emulsionizes fats, and increases intestinal peristalsis. The drug liquefies the bile, and acts as a cholagogue and purgative. It is a useful cathartic when the stools are very offensive and of a light clay color, indicating a deficient biliary secretion. The drug is serviceable in *jaundice* due to obstruction of the common duct by inspissated bile or mucus. *Impacted feces* are readily removed by an enema containing 15 or 20 grains (1.0–1.3 Gm.) of oxgall. The drug is an efficient intestinal antiseptic, and may be beneficially employed for that purpose in *typhoid fever* and *intestinal fermentation.*

Oxgall is usually given in pill form.

Rhēum—Rhēi—Rhubarb. *U. S. P.*

Origin.—The root of *Rheum officinale* Baillon, a plant indigenous in the western and northwestern portions of China.

Description and Properties.—In cylindrical, conical, or flattish

segments, deprived of the dark-brown, corky layer, smoothish or somewhat wrinkled, externally covered with a bright yellowish-brown powder, marked with white, elongated meshes, containing a white, rather spongy tissue, and a number of short, reddish-brown or brownish-yellow striæ; compact, hard; fracture uneven; internally white, with numerous red, irregularly-curved, and interrupted medullary rays, which are radially parallel only near the cambium line; odor somewhat peculiar, aromatic; taste bitter, somewhat astringent. When chewed, rhubarb feels gritty between the teeth and imparts a yellow color to the saliva. Rhubarb which is very porous, or has a prominently mucilaginous taste, or is of a dark-brown color internally, should be rejected.

The drug contains the following constituents: *chrysophan* (and chrysophanic acid), emodin, aparetin, phæoretin, erythroretin, rheumic acid, and rheotannic acid, besides starch, calcium oxalate, etc.

Dose.—5–30 grains (0.32–1.94 Gm.).

Official Preparations.

Extractum Rhei—Extracti Rhei—Extract of Rhubarb.—*Dose*, 3–15 grains (0.19–1.0 Gm.).

Extractum Rhei Fluidum—Extracti Rhei Fluidi—Fluid Extract of Rhubarb (this preparation is used in Mistura Rhei et Sodæ and in Syrupus Rhei).—*Dose*, 5–30 minims (0.3–2.0 Cc.).

Pilulæ Rhei—Pilulas (acc.) **Rhei—Pills of Rhubarb.**—Each pill contains 3 grains (0.19 Gm.). *Dose*, 1 to 5 pills.

Pilulæ Rhei Compositæ—Pilulas (acc.) **Rhei Compositas—Compound Rhubarb Pills.**—Each pill contains about 2 grains (0.12 Gm.) of Rhubarb, with purified Aloes 1½ grains (0.09 Gm.), Myrrh, and Oil of Peppermint. *Dose*, 1 to 3 pills.

Pulvis Rhei Compositus—Pulveris Rhei Compositi—Compound Rhubarb Powder (GREGORY'S POWDER)—(25 per cent., with Magnesia and Ginger).—*Dose*, ½–1 drachm (2.0–4.0 Gm.).

Tinctura Rhei—Tincturæ Rhei—Tincture of Rhubarb (10 per cent., with Cardamom).—*Dose*, ½–4 fluidrachms (2.0–15.0 Cc.).

Tinctura Rhei Aromatica—Tincturæ Rhei Aromaticæ—Aromatic Tincture of Rhubarb (20 per cent., with Cassia, Cinnamon, Cloves, and Nutmeg).—*Dose*, 1–3 fluidrachms (4.0–12.0 Cc.).

This preparation is used to make Syrupus Rhei Aromaticus.

Tinctura Rhei Dulcis—Tincturæ Rhei Dulcis—Sweet Tincture of Rhubarb (10 per cent., with Glycyrrhiza, Anise, and Cardamom).—*Dose*, ½–4 fluidrachms (2.0–15.0 Cc.).

Mistura Rhei et Sodæ—Misturæ Rhei et Sodæ—Mixture of Rhubarb and Soda.—Formula: Sodium Bicarbonate, 35; Fluid Extract of Rhubarb, 15; Fluid Extract of Ipecac, 3; Glycerin, 350; Spirit of Peppermint, 35; Water, to 1000.—*Dose*, ¼–2 fluidounces (8.0–60.0 Cc.).

Syrupus Rhei—Syrupi Rhei—Syrup of Rhubarb.—Formula: Fluid Extract

of Rhubarb, 100; Potassium Carbonate, 10; Spirit of Cinnamon, 4; Glycerin, 50; Water and Syrup, to 1000.—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Sȳrupus Rhēi Aromăticus—Sȳrupi Rhēi Aromătici—Aromatic Syrup of Rhubarb.—Formula: Aromatic Tincture of Rhubarb, 150; Syrup, 850.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Physiological Action and Therapeutics.—Rhubarb in moderate doses is a stomachic, acting similarly to the aromatic bitters, increasing secretion, peristalsis, vascularity, and absorption, thereby aiding digestion and serving as a tonic. In larger doses it is a mild cathartic, producing in from four to eight hours a soft yellowish-brown evacuation, not watery, which is not infrequently accompanied by griping.

It undoubtedly slightly increases the secretion of bile, though it is by no means an active hepatic stimulant.

After full doses of rhubarb have been taken the purgative action is succeeded by quiescence of the bowels, the constipation being the result of the action of the astringent constituents of the rhubarb. Small doses, however, taken daily, serve a useful purpose in relieving *habitual constipation*, without in the least impairing digestion.

The drug is excreted with the feces, urine, perspiration, and milk; the urine is slightly increased in amount, and together with the perspiration and milk, is colored yellow. The milk acquires a bitter taste and purgative properties.

Rhubarb is one of the best purgatives for children suffering from *diarrhea* caused by irritating ingesta in the bowels or to cold; it is also of value in some cases of *dysentery*. *Summer diarrhea of children* is often cured by some preparation of rhubarb alone, the diarrhea ceasing after a free purge by the drug.

As a simple laxative for children it is a valuable remedy, owing to its secondary tonic and astringent effects, and is recommended as a laxative to expel *thread-worms*.

When *hemorrhoids* are connected with constipation, much relief may be obtained by the gentle action of rhubarb.

Administration.—Rhubarb is seldom given alone, because of the griping it occasions. For children the syrups are excellent preparations, and the mixture of rhubarb and soda is an appropriate remedy when the secretions of the stomach and bowels are unduly acid.

In habitual constipation of adults the simple rhubarb pill is an efficient preparation.

The choice of the preparation will depend largely upon the individual case.

Euŏnymus—Euŏnymi—Euonymus. *U. S. P.*

(Wahoo.)

Origin.—The bark of the root of *Euonymus atropurpureus* Jacquin, a shrub 6 to 10 or 14 feet (1.8 to 3 or 4.2 M.) high, found growing in shady woods of the northern and middle section of the United States east of the Mississippi.

Description and Properties.—In quilled or curved pieces $\frac{1}{12}$ to $\frac{1}{8}$ inch (2 to 5 Mm.) thick; outer surface ash-gray, with blackish patches, detached in thin and small scales; inner surface whitish or slightly tawny, smooth; fracture smooth, whitish, the inner layers of a laminated appearance; nearly inodorous; taste sweetish, somewhat bitter and acrid.

The chief constituent of the drug is a resin, *euonymin.*

Dose.—1–2 drachms (4.0–8.0 Gm.).

Official Preparation.

Extrăctum Euŏnymi—Extrăcti Euŏnymi—Extract of Euonymus.—*Dose*, 1–5 grains (0.06–0.3 Gm.).

Euŏnymin (unofficial).—*Origin.*—A resin from the root and stem-bark of *Euonymus atropurpureus* Jacquin.

Description and Properties.—A brown or greenish-brown hygroscopic powder with a feebly bitter taste, soluble in water, almost insoluble in alcohol and ether.

Dose.—¼–3 grains (0.01–0.19 Gm.).

Physiological Action and Therapeutics.—Euonymus resembles rhubarb in its action, but is milder, small doses being stimulant to the stomach. The drug is an active hepatic stimulant, increasing the secretion of bile and facilitating its excretion into the intestine. It is excreted by the kidneys and broncho-pulmonary mucous membrane, being a mild diuretic and expectorant. Euonymus is an excellent cathartic, particularly in cases of *constipation* attended with impaired functional activity of the liver.

Euonymin is the preparation usually employed, although the official extract of euonymus is a reliable preparation.

Īris—Īridis—Iris. *U. S. P.*

(Blue Flag.)

Origin.—The rhizome and roots of *Iris versicolor* L., found growing in wet and swampy meadows from Canada southward to Florida and westward to Minnesota and Arkansas.

Description and Properties.—Rhizome of horizontal growth, consisting of joints 2 to 4 inches (5 to 10 Cm.) long, cylindrical in the lower half, flattish near the upper extremity, and terminated by a circular scar, annulated from the leaf-sheaths, grayish-brown; roots long, simple, crowded near the broad end; odor slight; taste acrid and nauseous. The drug contains an acrid resin, *iridin*, fixed oil, starch, gum, tannin, sugar, and indications of an alkaloid.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Extractum Iridis—Extracti Iridis—Extract of Iris.—*Dose*, 1–3 grains (0.06–0.2 Gm.).

Extractum Iridis Fluidum—Extracti Iridis Fluidi—Fluid Extract of Iris.—*Dose*, 10–30 minims (0.6–2.0 Cc.).

Iridin (UNOFFICIAL).—*Dose*, 1–3 grains (0.06–0.2 Gm.).

Physiological Action and Therapeutics.—Iris is similar in its action to euonymus, although it is more apt to disturb the stomach and occasion nausea. It is actively purgative and possesses diuretic properties. Like euonymus, it is a hepatic stimulant, and may be used for the same purposes as the former drug. It may be used in *dropsy*, and has been found to be an efficient cathartic in *malarial* and *catarrhal jaundice* and *bilious remittent fever*. It exerts a specific influence in *enlargement of the thyroid gland*.

The dried drug is inert, the fluid extract and iridin being the most reliable preparations to use.

Jūglans—Juglăndis—Juglans. *U. S. P.*

(BUTTERNUT.)

Origin.—The bark of the root of *Juglans cinerea* L., a tree 30 to 40 feet (9–12 M.) high, growing in forest and bottom-lands in Canada, and the greater portion of the United States westward to Missouri and Arkansas.

Description and Properties.—In flat or curved pieces, from $\frac{1}{8}$ to $\frac{1}{4}$ inch (3 to 6 Mm.) thick; the outer surface dark gray and nearly smooth or deprived of the soft cork, and deep brown; the inner surface smooth and striate; transverse fracture short, delicately checkered, whitish and brown; odor feeble; taste bitter and somewhat acrid. The drug contains a bitter, oily extractive, *juglandic acid*, two other acids, and various salts.

Dose.—1–2 drachms (4.0–8.0 Gm.).

Official Preparation.

Extractum Juglandis—Extracti Juglandis—Extract of Juglans.—*Dose*, 5–30 grains (0.3–2.0 Gm.).

Physiological Action and Therapeutics.—The action and medical uses of this drug are analogous to those of euonymus.

Leptandra—Leptandræ—Leptandra. *U. S. P.*

(Culver's Root.)

Origin.—The rhizome and roots of *Veronica virginica* L., a plant indigenous in Canada, and in the United States as far west as the Mississippi Valley.

Description and Properties.—Of horizontal growth, from 4 to 6 inches (10 to 15 Cm.) long and about ¼ inch (6 Mm.) thick, somewhat flattened, bent and branched, deep blackish-brown, with cup-shaped scars on the upper side, hard, of a woody fracture, with a thin, blackish bark, a hard, yellowish wood, and a large, purplish-brown, about six-rayed pith; roots thin, wrinkled, very fragile; inodorous; taste bitter and feebly acrid.

Leptandra contains a crystalline glucosid, *leptandrin*, besides tannin, gum, and a small quantity of volatile oil.

Dose.—15–60 grains (1.0–4.0 Gm.).

Official Preparations.

Extractum Leptandræ—Extracti Leptandræ—Extract of Leptandra.—*Dose*, 1–5 grains (0.06–0.3 Gm.).

Extractum Leptandræ Fluidum—Extracti Leptandræ Fluidi—Fluid Extract of Leptandra.—*Dose*, 15–60 minims (1.0–4.0 Cc.).

The **Pilulæ Catharticæ Vegetabiles** contain ¼ grain (0.01 Gm.) of Extract of Leptandra to each pill.

Leptandrin (unofficial).—*Dose*, 1–3 grains (0.06–0.2 Gm.).

Physiological Action and Therapeutics.—The action of leptandra is similar to the actions of euonymus, iris, and juglans, the green root, however, being more of an irritant to the gastro-intestinal tract, possessing marked emeto-cathartic properties.

It is an active hepatic stimulant, and may be advantageously employed for the same purposes as euonymus, iris, etc.

Sĕnna—Sĕnnæ—Senna. *U. S. P.*

Origin.—The leaflets of *Cassia acutifolia* Delile (Alexandria senna) and of *Cassia angustifolia* Vahl (India senna), small shrubs

found in Upper Egypt and southward to Nubia, Sennaar, and Kordofan, and farther westward in tropical Africa (*Cassia acutifolia*), and in Southwestern Arabia, along the Somali coast of Africa, and eastward in Northern India (*Cassia angustifolia*).

Description and Properties.—*Alexandria senna* consists of leaflets about 1 inch (25 Mm.) long and ⅜ inch (10 Mm.) broad, lanceolate or lance-oval, subcoriaceous, brittle, rather pointed, unequally oblique at the base, entire, grayish-green, somewhat pubescent; of a peculiar odor and a nauseous, bitter taste.

India senna consists of leaflets 1 to 2 inches (2.5–5 Cm.) long and ⅜ to ⅝ inch (10–15 Mm.) broad, lanceolate, acute, unequally oblique at the base, entire, thin, yellowish-green or dull green, nearly smooth; odor peculiar, somewhat tea-like; taste mucilaginous, bitter, and nauseous.

Senna contains a sulphuretted glucosid, *cathartic acid*, to which the purgative properties of the drug are due. Senna also contains *chrysophan*, besides sennacrol and sennapicrin (two bitter principles), catharto-mannite, mucilage, etc.

Dose.—10 grains–3 drachms (0.6–12.0 Gm.).

Official Preparations.

Confĕctio Sĕnnæ—Confectiōnis Sĕnnæ—Confection of Senna.—10 per cent., with Cassia Fistula, Tamarind, Prune, Fig, Sugar, and Oil of Coriander. *Dose*, 1–3 drachms (4.0–12.0 Gm.).

Extrăctum Sĕnnæ Flŭidum—Extrăcti Sĕnna Flŭidi—Fluid Extract of Senna.—*Dose*, 10 minims–3 fluidrachms (0.6–11.09 Cc.).

Infūsum Sĕnnæ Compŏsitum—Infūsi Sĕnnæ Compŏsiti—Compound Infusion of Senna.—6 per cent., with Manna and Magnesium Sulphate, each, 12 per cent., and Fennel 2 per cent. *Dose*, 1–2½ fluidounces (30.0–75.0 Cc.).

Pŭlvis Glycyrrhīzæ Compŏsitus—Pŭlveris Glycyrrhīzæ Compŏsiti—Compound Powder of Glycyrrhiza.—Formula: Senna, 180; Glycyrrhiza, 236; Oil of Fennel, 4; Washed Sulphur, 80; Sugar, 500. *Dose*, ½–2 drachms (2.0–8.0 Gm.).

Sўrupus Sĕnnæ—Sўrupi Sĕnnæ—Syrup of Senna (25 per cent.).—*Dose*, ¼–1 fluidounce (8.0–3.0 Cc.).

Cathartic Acid, Cathartinic Acid (UNOFFICIAL).—*Origin.*—An active principle obtained from the leaves of various species of *Cassia*.

Description and Properties.—It occurs as brown, hygroscopic scales, freely soluble in water and in alcohol.

Dose.—2–6 grains (0.12–0.38 Gm.).

Physiological Action and Therapeutics.—Senna is an active purgative, acting upon nearly the entire intestinal tract, increasing both peristalsis and intestinal secretion, although having but little effect upon the biliary secretion. It is apt to occasion much flatulence and griping unless it is associated with aromatics. Full doses

open the bowels in from four to eight hours, producing one or more copious liquid, yellow stools, but never occasioning hypercatharsis, and the purgation is not followed by constipation.

An infusion of senna, if injected into the veins, excites both vomiting and purging.

Some persons are so susceptible to the influence of senna as to be purged even by its odor.

The drug, or some constituent of it, is eliminated by the urine, to which it imparts a red color, and by the milk, rendering it purgative.

The various preparations of senna are very efficient purgatives in cases of simple *constipation* or in cases of *fecal accumulation in the colon.*

INFUSION OF SENNA is an admirable purgative with which to succeed the administration of blue pill. In cases of *biliousness* there is probably no better treatment than calomel or blue pill at night and infusion of senna in the morning.

Habitual constipation and the *constipation of pregnancy* are safely and agreeably treated by COMPOUND LIQUORICE POWDER.

Administration.—Senna is seldom given alone, but is generally associated with some corrective to prevent griping.

The infusion, compound liquorice powder, syrup, and confection of senna are employed.

The compound liquorice powder and the confection being the mildest and pleasantest, the latter preparation, when coated with chocolate, is readily taken by children, and in this form is the well-known laxative "*Tamar Indien.*"

HYDRAGOGUE PURGATIVES.

These drugs are more active than the preceding class, producing an abundant secretion from the intestinal mucous membrane, removing a large quantity of water from the blood-vessels, and producing several copious, watery stools.

Ōleum Tīglii—Ōlei Tīglii—Croton Oil. *U. S. P.*

Origin.—A fixed oil expressed from the seed of *Croton Tiglium* L., indigenous in Hindostan and some of the East Indian and Philippine islands.

Description and Properties.—A pale-yellow or brownish-yellow, somewhat viscid, and slightly fluorescent liquid, having a slight, fatty odor, and a mild, oily, afterward acrid and burning, taste

(*great caution is necessary in tasting*). Croton oil should be kept in small, well-stoppered bottles, and should be handled with caution, for when applied to the skin it produces rubefaction or a pustular eruption.

When fresh, croton oil is soluble in about 60 parts of alcohol, the solubility increasing by age.

The drug contains several volatile acids, of which *tiglinic acid* is the characteristic one; besides this, it contains lauric, myristic, palmitic, stearic, formic, acetic, isobutyric, and isovalerianic acids.

Dose.—$\frac{1}{4}$–2 minims (0.01–0.12 Cc.) on a lump of sugar or mixed with some bland oil.

Physiological Action.—*Externally and Locally.*—Croton oil is a powerful irritant when applied to the skin, exciting inflammation and quickly producing vesication, which rapidly merges into pustules closely resembling those of variola, and perhaps lasting several days. In many cases permanent cicatrices mark the sites of these pustules.

If the drug be rubbed over the abdomen, it may produce purgation. The irritating action is wholly due to the free croton-oleic acid which the oil contains.

Internally.—When a drop or two of croton oil is taken into the stomach it occasions a sense of heat in the epigastrium, which is soon succeeded by griping and abdominal pain, and in from half an hour to two hours after the ingestion of the drug there are produced profuse watery stools, with considerable burning and irritation about the anus.

The drug greatly increases the vascularity of, and the secretion from, the gastro-intestinal tract, without specially influencing the biliary secretion.

Large doses produce violent gastro-enteritis, hypercatharsis, with great prostration and collapse resembling that of cholera.

In case of *poisoning* the stomach should be immediately evacuated, and demulcent drinks freely given. Opium and stimulants may be necessary.

Therapeutics.—*Externally and Locally.*—The external use of croton oil is comparatively limited.

It is occasionally painted over the seat of pain in *intercostal neuralgia*, while a liniment of croton oil applied to the chest is said to be beneficial in *phthisis* and *chronic bronchitis*. The same preparation is recommended as a local application in *congestive dysmenorrhœa* and *chronic congestion of the uterus*.

Croton oil has been put to many other uses, but the results obtained are so unsatisfactory that it is needless to enumerate them.

Internally.—The drug is used as a purgative, as a rule only in cases of emergency, and then a single dose is usually sufficient. It is employed in such cases as *intestinal obstruction from accumulated feces* produced by torpor of the bowels, *diseases of the nervous system*, *lead-poisoning*, etc. In *lead colic* it is probably superior to all other purgatives.

Croton oil is sometimes employed for its revulsive action in *apoplexy*.

As a purgative it is frequently given to the insane, because, on account of the smallness of the dose, it may be easily placed on the back of the tongue, where it is quickly swallowed reflexly.

Contraindications.—The drug should never be given to pregnant women, to children, nor to patients suffering from hemorrhoids, peritonitis, gastritis, or enteritis.

Administration.—Croton oil may be given in emulsion, or mixed with some bland oil, or dropped on a piece of loaf sugar, or in pill form.

The best excipient for pills of croton oil is breadcrumb.

Elaterīnum—Elaterīni—Elaterin. *U. S. P.*

Origin.—A neutral principle obtained from Elaterium, a substance deposited by the juice of the fruit of *Ecballium elaterium* L., commonly known as "squirting cucumber," a vine growing in the Mediterranean regions of Europe, Africa, and Asia.

Description and Properties.—Minute, white, hexagonal scales or prismatic crystals, without odor, and having a slightly acrid, bitter taste; permanent in the air; soluble in 4250 parts of water and 337 parts of alcohol.

Dose.—$\frac{1}{30}$–$\frac{1}{12}$ grain (0.002–0.005 Gm.).

Official Preparation.

Triturātio Elaterīni—Trituratiōnis Elaterīni—Trituration of Elaterin.—*Dose*, about $\frac{3}{4}$ grain (0.05 Gm.).

Physiological Action and Therapeutics.—Elaterin is the most powerful hydragogue purgative known.

The drug greatly increases the salivary, gastric, and intestinal secretions, as well as those from the liver and pancreas.

It is a violent purgative, whether given internally or injected

subcutaneously, producing abundant watery evacuations attended with much griping pain and great prostration.

Elaterin is indicated where profuse serous discharges are desired, as in cases of *congestion of the brain* and *lungs, ascites,* and *chronic nephritis.*

Contraindications.—The drug is not permissible in inflammatory conditions of the gastro-intestinal tract, nor in pregnancy, and it should be administered with much care, if at all, in *heart disease.*

Administration.—The drug may be given in pill form, in alcoholic solution, or in the form of the trituration. Elaterin varies greatly in strength, which suggests caution in its use.

Cambōgia—Cambōgiæ—Gamboge. *U. S. P.*

Origin.—A gum-resin obtained from *Garcinia Hanburii* Hooker filius, a medium-sized tree, indigenous in Siam, Cambodia, and Cochin China.

Description and Properties.—In cylindrical pieces, sometimes hollow in the center, 1 to 2 inches (2 to 5 Cm.) in diameter, longitudinally striate on the surface; fracture flattish-conchoidal, of a waxy luster, orange-red; in powder bright yellow; inodorous; taste very acrid; the powder sternutatory. Gamboge is partly soluble in alcohol and in ether.

Dose.—1–5 grains (0.06–0.32 Gm.).

Official Preparation.

Pĭlulæ Cathărticæ Compŏsitæ—Pĭlulas (acc.) **Cathărticas Compŏsitas—Compound Cathartic Pills.**—*Dose,* 1–3 pills.

Physiological Action and Therapeutics.—Gamboge is a violent hydragogue purgative, exciting active peristalsis and greatly augmenting the secretion from the intestinal glands, although not increasing the secretion of bile. Small and repeated doses are slightly diuretic, coloring the urine yellow.

Gamboge is seldom given alone, being usually associated with other purgatives. It is used in combination when a hydragogue action by the kidneys as well as the bowels is desired. It is thought to be of use in *hepatic congestion* arising from malarial causes. The drug is an efficient anthelmintic, and is occasionally prescribed with vermicide medicines.

SALINES.

Magnēsii Cĭtras Effervĕscens—Magnēsii Citrātis Effervescĕntis—Effervescent Magnesium Citrate. *U. S. P.*

Formula: Magnesium Carbonate, 10; Citric Acid, 46; Sodium Bicarbonate, 34; Sugar, 8; Alcohol and Distilled Water, a sufficient quantity.

Description and Properties.—A white, coarsely granular salt, without odor, and having a mildly acidulous, refreshing taste. Deliquescent on exposure to the air. Soluble, with copious effervescence, in 2 parts of water; almost insoluble in alcohol. The product should be kept in well-closed vessels.

Dose.—¼–1 ounce (8.0–32.0 Gm.).

Lĭquor Magnēsii Citrātis—Liquōris Magnēsii Citrātis—Solution of Magnesium Citrate. *U. S. P.*

Formula: Dissolve Magnesium Carbonate, 15, in a solution of Citric Acid, 30; add Syrup of Citric Acid, 60; then Crystals of Potassium Bicarbonate, 25. Cork the bottle and wire immediately. The product effervesces when uncorked.

Dose.—2–8 fluidounces (60.0–237.0 Cc.).

Magnēsii Sŭlphas—Magnēsii Sulphātis—Magnesium Sulphate. *U. S. P.*

(Epsom Salt.)

Origin.—Obtained by the action of Sulphuric Acid upon native Magnesium Carbonate, treated with Water, filtered, and the filtrate evaporated to crystallization.

Description and Properties.—Small, colorless, rhombic prisms or acicular crystals, without odor, and having a cooling, saline, and bitter taste; slowly efflorescent in dry air. Soluble in 1.5 parts of water; insoluble in alcohol.

Dose.—¼–1 ounce (8.0–32.0 Gm.).

Antagonists and Incompatibles.—Magnesium sulphate is incompatible with alkaline carbonates, phosphoric acid, phosphates, lead acetate, silver nitrate, and lime water.

Synergists.—Saline purgatives.

Potăssii Sŭlphas—Potăssii Sulphātis—Potassium Sulphate. *U. S. P.*

Origin.—Prepared by adding Potassium Carbonate to Acid Potassium Sulphate.

Description and Properties.—Hard, colorless, transparent, six-sided, rhombic prisms terminated by pyramids, or in white powder; odorless, and having a somewhat bitter, saline taste. Permanent in the air. Soluble in about 9.5 parts of water, insoluble in alcohol.

Dose.—½–4 drachms (2.0–16.0 Gm.).

Potăssii et Sōdii Tărtras—Potăssii et Sōdii Tartrātis—Potassium and Sodium Tartrate. *U. S. P.*

(ROCHELLE SALT.)

Origin.—Prepared by adding Acid Potassium Tartrate to a hot solution of Sodium Carbonate.

Description and Properties.—Colorless, transparent rhombic prisms, or a white powder, odorless, and having a cooling, saline taste. The crystals slightly effloresce in dry air. Soluble in 1.4 parts of water, almost insoluble in alcohol.

Dose.—30 grains–1 ounce (2.0–32.0 Gm.).

Official Preparation.

Pŭlvis Effervĕscens Compŏsitus—Pŭlveris Effervescĕntis Compŏsiti—Compound Effervescing Powder (SEIDLITZ POWDER).—Each powder has of Rochelle Salt, 120 grains (8.0 Gm.); of Sodium Bicarbonate, 40 grains (3.0 Gm.), mixed in a blue paper; and of Tartaric Acid, 35 grains (2.26 Gm.), in a white paper.

Dose.—One or two of each dissolved separately in separate quantities of water, the solutions poured together and drunk while effervescing.

Sōdii Phŏsphas—Sōdii Phosphātis—Sodium Phosphate. *U. S. P.*

(SODIUM ORTHOPHOSPHATE.)

Origin.—Prepared by digesting Bone Ash with Sulphuric Acid. The solution is filtered, and to it is added Sodium Carbonate, and the filtrate evaporated to crystallization.

Description and Properties.—Large, colorless, monoclinic prisms, odorless, and having a cooling, saline taste. The crystals effloresce in the air, and gradually lose 5 molecules of water of crystallization. Soluble in 5.8 parts of water; insoluble in alcohol. Sodium phosphate should be kept in well-stoppered bottles, in a cool place.

Dose.—5 grains–1 ounce (0.32–32.0 Gm.).

Sōdii Sŭlphas—Sōdii Sulphātis—Sodium Sulphate. *U. S. P.*

(GLAUBER'S SALT.)

Origin.—The residue left in the manufacture of Hydrochloric Acid from Salt is neutralized with Sodium Carbonate.

Description and Properties.—Large, colorless, transparent, monoclinic prisms or granular crystals; odorless, and having a bitter, saline taste. The salt effloresces rapidly in the air, and finally loses all its water of crystallization. Soluble in 2.8 parts of water and in glycerin; insoluble in alcohol.

Dose.—1–8 drachms (4.0–32.0 Gm.).

Physiological Action and Therapeutics of the Salines.—These preparations greatly augment the amount of fluid in the intestinal canal. This increase of fluid is not a secretion, but a result of the high osmotic equivalent of the salts which tends to draw the body-fluids into the intestines, while hindering to a certain extent absorption of fluid from the intestines. The purgative influence is really due to the mechanical action of the fluid in the intestines.

Save the sulphate and phosphate of sodium, which are mild hepatic stimulants, the salines have no effect upon the biliary secretions.

The sodium salts are more efficient than the potassium salts as purgatives, owing to their higher osmotic equivalents.

Purgation by the salines is painless, and occurs usually in from two to three hours after administration, there being ordinarily two or three watery evacuations.

In cases of *habitual constipation*, particularly that associated with the *gouty diathesis*, there are no better purgatives than the SALTS OF SODIUM or mineral waters containing them, such as Carlsbad, Marienbad, Hunyadi Janos, etc.

For children there is no better purgative than SODIUM PHOSPHATE, especially where the stools show a deficiency of bile. In *duodenal catarrh* excellent results are obtained by this drug; also in *chronic rheumatism*, and to retard the formation of *biliary calculi*.

Concentrated saline purgatives are efficient remedies for the removal of *dropsical* and *pleuritic effusions*.

MAGNESIUM SULPHATE, combined with dilute sulphuric acid, is the most efficient treatment in cases of *chronic lead-poisoning*.

ROCHELLE SALT and SEIDLITZ POWDER are pleasant and useful purgatives in cases of *biliousness*, *migraine*, etc. SOLUTION OF MAG-

NESIUM CITRATE is used for the same purpose, but, while very palatable and acceptable to the stomach, is not always reliable, besides being apt to occasion slight griping.

Administration.—The salines should be taken dissolved in as concentrated a solution as possible, and ordinarily should be administered in the morning, when the stomach is empty.

DRASTIC PURGATIVES.

These drugs are even harsher in their action than hydragogue purgatives, exciting violent peristalsis, and in large doses producing gastro-enteritis and all the symptoms occasioned by an irritant poison. The evacuations produced by these drugs are numerous, copious, and watery, attended with much griping pain, tenesmus, and borborygmi.

Colocynthis—Colocynthidis—Colocynth. *U. S. P.*

Origin.—The fruit of *Citrullus Colocynthis* Schroder, deprived of its rind. The colocynth plant is indigenous in Japan and is cultivated and naturalized in Spain.

Description and Properties.—From 2 to 4 inches (5–10 Gm.) in diameter; globular; white or yellowish-white, light, spongy; readily breaking into three wedge-shaped pieces, each containing, near the rounded surface, many flat, ovate, brown seeds; inodorous; taste intensely bitter.

The active constituent of colocynth is *colocynthin*, a glucosid, of which there is present about 2 per cent. Colocynth also contains resin, gum, and an amyloid principle.

Dose.—5–10 grains (0.3–0.6 Gm.).

Official Preparations.

Extractum Colocynthidis—Extracti Colocynthidis—Extract of Colocynth. *Dose*, ½–2 grains (0.03–0.13 Gm.).

Extractum Colocynthidis Compositum—Extracti Colocynthidis Compositi—Compound Extract of Colocynth.—Extract of Colocynth 16 per cent., with Aloes Scammony, Cardamom, and Soap.

Dose.—5–25 grains (0.3–1.6 Gm.).

Compound Extract of Colocynth enters into the following pills:

Pilulæ Catharticæ Compositæ (8 per cent.).

Pilulæ Catharticæ Vegetabiles (6 per cent.).

Physiological Action and Therapeutics.—The action of colocynth is very similar to that of elaterin. In small doses, however,

it rather acts as a stomachic, improving the appetite and augmenting the secretions of the whole gastro-intestinal tract. Colocynth is quite a decided hepatic stimulant and cholagogue.

Pills containing colocynth are useful to produce abundant watery evacuations, as is necessary sometimes in the treatment of *hepatic* and *renal diseases* where there is *constipation* and *ascites.*

The drug should be employed only when there is some marked indication for its use, as colocynth, like the other drastics, is too irritant for habitual use.

Gastro-intestinal inflammation, pregnancy, etc., would contra-indicate its use.

Jalāpa—Jalāpæ—Jalap. *U. S. P.*

Origin.—The tuberous root of *Ipomœa Jalapa* Nuttall, a twining herbaceous perennial growing in damp and shady woods on the eastern slope of the Mexican Andes. It has been introduced into India and Jamaica.

Description and Properties.—Napiform, pyriform, or oblong, varying in size, the large roots incised, more or less wrinkled, dark brown, with lighter-colored spots and short, transverse ridges; hard, compact, internally pale grayish-brown, with numerous concentric circles composed of small resin-cells; fracture resinous, not fibrous; odor slight, but peculiar, smoky, and sweetish; taste sweetish and acrid.

Jalap contains two resins, one hard, the other soft, the former, termed *jalapin* or *convolvulin*, being the active principle of the drug. According to the U. S. Pharmacopœia, there must be not less than 12 per cent. of resin, of which not less than 10 per cent. must be soluble in ether.

Dose.—5–30 grains (0.32–2.0 Gm.).

Official Preparations.

Extrăctum Jalāpæ—Extrăcti Jalāpæ—Extract of Jalap.—*Dose*, 2–5 grains (0.13–0.3 Gm.).

Pŭlvis Jalāpæ Compŏsitus—Pŭlveris Jalāpæ Compŏsiti—Compound Jalap Powder (35 per cent., with Potassium Bitartrate).— *Dose*, 15–60 grains (1.0–4.0 Gm.).

Resīna Jalāpæ—Resīnæ Jalāpæ—Resin of Jalap.—*Description and Properties.*—Yellowish-brown or brown masses or fragments, breaking with a resinous, glossy fracture, translucent at the edges, or a yellowish-gray or yellowish-brown powder, having a slight, peculiar odor, and a somewhat acrid taste. Permanent in the air. Soluble in alcohol in all proportions.

Dose.—2–5 grains (0.13–0.3 Gm.).

Extract of Jalap is one of the ingredients of **Pĭlulæ Cathărticæ Compŏsitæ** and **Pĭlulæ Cathărticæ Vegetăbiles.**

Physiological Action and Therapeutics. — The purgative action of jalap is developed in the duodenum, where it comes in contact with the bile. The secretion from the intestinal glands is greatly augmented, as well as the vascularity and peristalsis of the intestines. The biliary flow is but little affected.

Purgation is produced by jalap in three or four hours, the evacuations being profuse and watery and attended with griping pain.

Jalap—or, preferably, the compound jalap powder—is a reliable hydragogue cathartic for the removal of *dropsical effusions*, being especially appropriate for nephritic patients.

Small doses of jalap are serviceable in *constipation* due to deficient intestinal secretion.

The drug is frequently associated with anthelmintic medicines as a vermifuge.

Scammōnium—Scammōnii—Scammony. *U. S. P.*

Origin.—A resinous exudation from the living root of *Convolvulus Scammonia* L., a herbaceous, twining perennial, growing in Syria, Asia Minor, and Greece.

Description and Properties.—Occurring in irregular angular pieces or circular cakes, greenish-gray or blackish, internally porous, and breaking with an angular fracture, of a resinous luster; odor peculiar, somewhat cheese-like; taste slightly acrid; powder gray or greenish-gray.

It contains a resin, *jalapin*, which is the active principle, besides gum, starch, etc.

Dose.—1–15 grains (0.06–1.0 Gm.).

Official Preparation.

Resīna Scammōnii—Resīnæ Scammōnii—Resin of Scammony.—*Description and Properties.*—Yellowish-brown or brownish-yellow masses or fragments, breaking with a glossy, resinous fracture, translucent at the edges, or a yellowish-white or grayish-white powder, having a faint, peculiar odor, and a slight, peculiar taste. Soluble in alcohol in all proportions.

Dose.—1–8 grains (0.06–0.5 Gm.).

Physiological Action and Therapeutics.—The action of scammony is identical with that of jalap, save that it stimulates the muscular coat of the intestines more, producing more irritation and griping than jalap, though not increasing secretion so much as the latter drug.

The therapeutics are the same as for jalap.

The drug may be given in powder, emulsion, or in milk, but is inactive in pilular form.

Podophȳllum—Podophȳlli—Podophyllum. *U. S. P.*

(May Apple.)

Origin.—The rhizome and roots of *Podophyllum peltatum* L., an herbaceous perennial growing in rich woodlands in Canada and the United States.

Description and Properties.—Of horizontal growth, consisting of joints about 2 inches (5 Cm.) long, flattish cylindrical, about ¼ inch (6 Mm.) thick, but somewhat enlarged at the end, which has a circular scar on the upper side, a tuft of about ten nearly simple, fragile roots on the lower side, and is sometimes branched laterally; smooth or somewhat wrinkled, orange-brown, internally white and mealy, with a circle of small wood-bundles; pith large; nearly inodorous; taste sweetish, somewhat bitter and acrid.

Podophyllum contains a resin, *podophyllin*, composed principally of *podophyllotoxin*, which is probably a mixture of *picropodophyllin*, the purgative principle, and *podophyllinic acid*, an inactive resin acid. Among other constituents of the drug are several minor resins and a coloring principle.

Dose.—5–20 grains (0.32–1.29 Gm.).

Official Preparations.

Extrăctum Podophȳlli—Extrăcti Podophȳlli—Extract of Podophyllum.—*Dose*, 1–3 grains (0.06–0.2 Gm.)

Extrăctum Podophȳlli Flūidum—Extrăcti Podophȳlli Flūidi—Fluid Extract of Podophyllum.—*Dose*, 5–20 minims (0.32–1.29 Cc.).

Resīna Podophȳlli—Resīnæ Podophȳlli—Resin of Podophyllum.—*Description and Properties.*—An amorphous powder, varying in color from grayish-white to pale greenish-yellow or yellowish-green, turning darker when exposed to heat; having a slight peculiar odor and a peculiar, faintly bitter taste; permanent in the air; soluble in alcohol in all proportions.

Dose.—¼–1 grain (0.008–0.06 Gm.).

Podophyllotŏxin (unofficial).—*Dose*, $\frac{1}{100}$–$\frac{1}{10}$ grain (0.0006–0.006 Gm.).

Physiological Action and Therapeutics.—The powdered root is an irritant to the skin, and when inhaled occasions a decided irritation of the eyes and respiratory passages. It is absorbed when applied to ulcers and raw surfaces, producing its characteristic purgative effects. The drug is a gastro-intestinal irritant, being

apt to excite nausea, in full doses producing salivation and greatly augmenting the intestinal secretions, and especially the bile. Under full doses of podophyllum there is marked peristalsis, attended with severe griping pains, and in the course of ten or twelve hours there is produced a complete evacuation of the bowels, the feces being liquid and deeply stained with bile.

The drug being one of the most active hepatic stimulants and cholagogues in the Pharmacopœia, it is a peculiarly appropriate remedy in that condition known as *torpor of the liver*. The *constipation* attending *hepatic cirrhosis* and *cancer*, as well as that from any hepatic disorder, is well treated by podophyllum.

The slowness and completeness of its action, together with its property of stimulating the functional activity of the liver, renders the drug extremely serviceable in the treatment of *habitual constipation* from any cause.

It should, however, be associated with antispasmodics, such as hyoscyamus or belladonna, to overcome its griping. When associated with other purgatives care should be exercised to select those only which, like itself, are tardy in their action.

Owing to the susceptibility of certain persons to the drug, the dosage should be small at first and gradually increased as necessary.

GROUP XV.—ANTHELMINTICS.

ANTHELMINTICS are remedies which kill or expel intestinal worms. Those drugs which kill the parasites are called *vermicides*, and those which simply promote their expulsion are called *vermifuges*.[1]

The *vermicides* are—

Aspidium,	Kamala,
Chenopodium,	Oleum Terebinthinæ,*
Cusso,	Pepo,
Granatum,	Santonica.

The *vermifuges* are—

Calomel,*	Spigelia.
Hydragogue Purgatives,*	

Anthelmintics are here divided according to the kind of intestinal parasite against which they are employed.

The *Oxyuris vermicularis* is the small worm, often called seat-

[1] Drugs marked with an asterisk (*) are considered elsewhere.

worm or thread-worm, that infests the large intestine and rectum. The *Ascaris lumbricoides* is the common round-worm, found chiefly in the small intestine.

The *Tæniæ* are the tape-worms.

Remedies employed against the Oxyuris vermicularis:

A weak solution of Carbolic Acid,*	Lime Water,*
Infusion of Quassia,*	Calomel,*
Decoction of Aloes,*	Oleum Terebinthinæ.*

Remedies employed against the Ascaris lumbricoides:

Chenopodium,	Calomel,*
Santonica,	Hydragogue Purgatives,*
Spigelia,	Oleum Terebinthinæ.*

Remedies employed against the Tænia Solium and other varieties of Tænia:

Aspidium,	Kamala,
Cusso,	Pepo,
Granatum,	Oleum Terebinthinæ.*

Chenopōdium—Chenopōdii—Chenopodium. *U. S. P.*

(American Wormseed.)

Origin.—The fruit of *Chenopodium ambrosioides* L., and the variety *anthelminticum* Gray, plants indigenous in the West Indies, and Central and South America, and naturalized in the United States.

Description and Properties.—Nearly $\frac{1}{12}$ inch (2 Mm.) in diameter, depressed globular, dull greenish or brownish, the integuments friable, and containing a lenticular, obtusely-edged, glossy, black seed. It has a peculiar, somewhat terebinthinate odor, and a bitterish, pungent taste. It contains a *volatile* oil, to which its medical properties are due.

Dose.—15–30 grains (1.0–2.0 Gm.).

Ōleum Chenopōdii—Ōlei Chenopōdii—Oleum Chenopodii. *U. S. P.*

(Oil of American Wormseed.)

Origin.—A volatile oil distilled from Chenopodium.

Description and Properties.—A thin, colorless or yellowish liquid, having a peculiar penetrating, somewhat camphoraceous odor, and a pungent and bitterish taste.

Dose.—2–10 minims (0.12–0.6 Cc.).

Physiological Action and Therapeutics.—Both the POWDERED SEED and the OIL are efficient anthelmintics, particularly useful to expel round-worms (*Ascarides lumbricoides*) from children. The drug should invariably be followed by a brisk cathartic. The powder may be given suspended in molasses, or the oil may be given dropped upon loaf-sugar, or in the form of an emulsion, or enclosed in capsules.

Santŏnica—Santŏnicæ—Santonica. *U. S. P.*

(LEVANT WORMSEED.)

Origin.—The unexpanded flower-heads of *Artemisia pauciflora* Weber, a plant growing in Asia and exclusively collected in Northern Turkestan.

Description and Properties.—From $\frac{1}{12}$ to $\frac{1}{8}$ inch (2 to 3 Mm.) long, oblong-ovoid, obtuse, smooth, somewhat glossy, grayish-green, after exposure to light brownish-green, consisting of an involucre of about twelve to eighteen closely imbricated, glandular scales with a broad midrib, enclosing four or five rudimentary florets; odor strong, peculiar, somewhat camphoraceous; taste aromatic and bitter. The drug contains about 2 per cent. of a neutral principle, *santonin*, to which its anthelmintic properties are due. It also contains about 1 per cent. of an unimportant volatile oil.

Dose.—10–60 grains (0.6–4.0 Gm.).

Santonīnum—Santonīni—Santonin. *U. S. P.*

Origin.—A neutral principle obtained from Santonica.

Description and Properties.—Colorless, shining, flattened, prismatic crystals, odorless, and nearly tasteless when first put into the mouth, but afterward developing a bitter taste; not altered by exposure to air, but turning yellow on exposure to light. Nearly insoluble in cold water; soluble in 40 parts of alcohol. Santonin should be kept in dark, amber-colored vials, and should not be exposed to light.

Dose.—$\frac{1}{4}$–1 grain (0.016–0.06 Gm.) for a child; 1–5 grains (0.06–0.32 Gm.) for an adult.

Official Preparation.

Trochīsci Santonīni—Trochīscos (acc.) **Santonīni—Troches of Santonin.**—Each troche contains $\frac{1}{2}$ grain (0.03 Gm.).—*Dose*, 2 (child) to 10 troches (adult).

Physiological Action and Therapeutics.—In full or large doses santonin may excite nausea or vomiting, with abdominal pain, diarrhea, eructations, borborygmi, and great thirst. It readily enters the blood, where it exists as sodium santoninate. Large doses may cause giddiness, headache, hallucinations of smell and taste, tremors, and a species of depression, the combination of symptoms forming what is called santonin intoxication.

The drug is chiefly eliminated through the kidneys, small amounts of santonin even imparting to the urine a distinct yellow color if the urine is acid, and a decided purplish or even red color if the urine is alkaline. Under certain circumstances when the urine is decidedly alkaline, as in cases of cystitis, the administration of santonin may produce so marked a discoloration of the urine as to suggest hematuria.

Probably the most remarkable phenomenon attending the ingestion of medicinal doses of santonin is that of xanthopsia or yellow vision, which may continue for several hours. According to Rose, "there occasionally appears before the peculiar yellow sight, after large doses of santonin, a violet color of the field of vision: the intensity of this color is in proportion to the darkness of the objects looked at. All light objects, such as windows, paper, etc., appear actually yellow. Red and blue appear often in their complementary colors, orange and green, so that carmine-red appears pale, madder-red a bronze color, and the sky and blue objects green. This, however, is not always the case, and it has been noticed after the employment of santonin that red appears violet or light, and dark objects appear orange to one person, and to another green." (Quoted from Lewin.) This peculiar effect of santonin is due, according to Rose, to a nervous change in the retina or in the brain.

Affections of the skin—*e. g.* urticaria—have occasionally followed the administration of santonin. Decidedly poisonous effects have sometimes been produced by comparatively small amounts of the drug. The symptoms of a fatal case from over-dose of santonin were convulsions accompanied by unconsciousness, twitching of the eyeballs, dilated pupils, cold sweat, weak pulse, feeble respiration, and, after some hours, sudden death.

In case of poisoning by santonin the remedial measures are internal and external stimulants, eliminants, and artificial respiration. Santonin is certainly a most efficient remedy against the *ascaris*, and to a less extent it is of use against the *oxyuris*. It has no effect on the *tænia*.

The drug should be given on an empty stomach, preferably at night, either alone or associated with calomel, and followed in two or three hours by castor oil or other brisk cathartic. It may be administered in the form of a powder mixed with sugar or jelly, or in pills or capsules. Troches of santonin are much used and are very efficient.

Spigēlia—Spigēliæ—Spigelia. *U. S. P.*

(PINKROOT.)

Origin.—The rhizome and roots of *Spigelia marilandica* L., a plant growing in rich shady woods, chiefly in the southern part of the United States, but found as far northward as Pennsylvania and Wisconsin.

Description and Properties.—Of horizontal growth, about 2 inches (5 Cm.) or more long, about $\frac{1}{8}$ inch (3 Mm.) thick, dark purplish-brown, bent, somewhat branched on the upper side, with cup-shaped scars; on the lower side with numerous thin, brittle, light-colored roots about 4 inches (10 Cm.) long; the rhizome internally with a whitish wood and a pith which is usually dark colored or decayed; odor somewhat aromatic; taste sweetish, bitter, and pungent.

It contains a volatile alkaloid, *spigeline*, which is the active principle.

Dose.—$\frac{1}{4}$–2 drachms (1.0–8.0 Gm.).

Official Preparation.

Extractum Spigēliæ Fluidum—Extracti Spigēliæ Fluidi—Fluid Extract of Spigelia.—*Dose*, $\frac{1}{4}$–2 fluidrachms (1.0–8.0 Cc.).

Physiological Action and Therapeutics.—Spigelia is a powerful anthelmintic, being a decided vermifuge against the *Ascaris lumbricoides*. When given alone and in full doses it may produce symptoms of narcotic poisoning. This may be obviated by associating it with cathartics and aromatics.

The drug may be administered in the form of a tea, associated with senna, fennel, or other aromatics. The fluid extract is a reliable preparation.

Remedies employed against the different varieties of Tænia:

Aspĭdium—Aspĭdii—Aspidium. *U. S. P.*

(MALE FERN.)

Origin.—The rhizome of *Dryopteris Filix mas* Schott and of *Dryopteris marginalis* Gray, plants indigenous in North America,

a portion of South America, Asia, Europe, and some parts of Africa.

Description and Properties.—From 3 to 6 inches (7 to 15 Cm.) long, ½ to 1 inch (12 to 25 Mm.) thick, and, together with the closely imbricated, dark-brown, roundish, and slightly curved stipe-remnants, 2 to 3 inches (50 to 75 Mm.) in diameter; densely covered with brown, glossy, transparent, and soft, chaffy scales; internally pale green, rather spongy; vascular bundles about ten (*Dryopteris Filix mas*) or six (*Dryopteris marginalis*) in number, arranged in an interrupted circle; odor slight, but disagreeable; taste sweetish, acrid, somewhat bitter, astringent, and nauseous. Aspidium contains *filicic acid*, tannaspidic acid, pteritannic acid, filicin (filicic acid anhydride), fixed oil, a trace of volatile oil, and chlorophyl.

Dose.—½–2 drachms (2.0–8.0 Gm.).

Official Preparation.

Oleoresīna Aspĭdii—Oleoresīnæ Aspĭdii—Oleoresin of Aspidium.—*Dose*, ¼–1 fluidrachm (1.0–4.0 Cc.).

NOTE.—Oleoresin of aspidium usually deposits, on standing, a granular crystalline substance. This should be thoroughly mixed with the liquid portion before use. The oleoresin should be kept in well-stoppered bottles.

Physiological Action and Therapeutics.—Aspidium is the most reliable *tæniacide* known to materia medica. Though it is employed against both the armed and unarmed varieties of tape-worm, it is nevertheless against the latter that it is specially effective. In the cases of armed tæniæ special precautions must be taken to ensure success.

The drug possesses tonic and astringent properties, and if taken in very large doses may occasion nausea, vomiting, diarrhea, and gastric and abdominal pains.

Several fatal cases of poisoning have occurred, and it is believed that the fatalities were due not so much to excessive dose as to increased absorption of the drug through the influence of the castor oil that had been administered with it.

When given for the expulsion of tape-worm the bowels should first be emptied by a castor-oil purge, and then the oleoresin be administered in gelatin capsules or in emulsion.

Previous to the exhibition of the anthelmintic the patient should for at least twenty-four hours live on exceedingly spare diet, and the medicine then be given in the morning fasting. A few hours

later an active purge of about 1 ounce (30.0 Cc.) of castor oil or calomel and jalap should be given to expel the dead worm, which should be carefully examined for the head. If the head did not pass, the treatment should be repeated the following day or soon after.

Cŭsso—Cŭsso—Kousso. *U. S. P.*

(BRAYERA.)

Origin.—The female inflorescence of *Hagenia Abyssinica* (Bruce) Gmelin, a handsome tree 40 to 50 feet (12 to 18 M.) high, indigenous on the table-land and in the mountainous districts of Abyssinia.

Description and Properties.—In bundles, rolls, or compressed clusters consisting of panicles about 10 inches (25.0 Cm.) long, with a sheathing bract at the base of each branch; the two roundish bracts at the base of each flower and the four or five obovate outer sepals are of a reddish color, membranous and veiny; calyx top-shaped, hairy, enclosing two carpels or nutlets; odor slight, fragrant, and tea-like; taste bitter, acrid, and nauseous.

It contains a neutral active principle, *kosin*, a tasteless and an acid resin, and about 24 per cent. of tannin.

Dose.—1–4 drachms (4.0–16.0 Gm.).

Official Preparation.

Extractum Cŭsso Flŭidum—Extracti Cŭsso Flŭidi—Fluid Extract of Cusso.—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Kosin—Koussein (unofficial).—*Origin.*—The active principle from the flowers and unripe fruits of *Hagenia Abyssinica* (Bruce) Gmelin.

Description and Properties.—An amorphous yellowish crystalline powder having a pungent bitter taste. Insoluble in water, but readily soluble in alcohol and in ether.

Dose, 15–30 grains (1.0–2.0 Gm.), to be divided into four doses and taken at intervals of half an hour.

Physiological Action and Therapeutics.—The action of kousso upon the digestive tract, under large doses, is similar to the action of aspidium. It is a reliable anthelmintic for all species of tapeworm. The fluid extract should be given in the form of an emulsion, the patient having previously fasted, and the exhibition of the drug followed in a few hours by a large dose of castor oil.

Granātum—Granāti—Pomegranate. *U. S. P.*

Origin.—The bark of the stem and root of *Punica Granatum* L., a shrub or small tree about 20 feet (6 M.) high, indigenous in Southwestern Asia from Northern India to Palestine.

Description and Properties.—In thin quills or fragments from 2 to 4 inches (5 to 10 Cm.) long and from $\frac{1}{25}$ to $\frac{1}{8}$ inch (1. to 3. Mm.) thick; outer surface yellowish-gray, somewhat warty or longitudinally and reticulately ridged; the stem-bark often partly covered with blackish lichens; the thicker pieces of the root-bark more or less scaly externally; inner surface smooth, finely striate, grayish-yellow; fracture short, granular, greenish-yellow, indistinctly radiate; inodorous; taste astringent, very slightly bitter.

It contains as its active constituent a liquid alkaloid, *pelletierine*, with its three allied alkaloids, *methyl-pelletierine*, *pseudo-pelletierine*, and *iso-pelletierine*, besides mannite and punico-tannic acid.

Dose.—$\frac{1}{2}$–1$\frac{1}{2}$ drachms (2.0–6.0 Gm.).

Unofficial Preparations.

Pellĕtierine.—*Origin.*—An alkaloid derived from the root-bark of *Punica granatum* L.

Description and Properties.—A colorless liquid. Soluble in 20 parts of water and miscible in all proportions with alcohol. It forms crystalline salts with acids, the principal one being the tannate.

There are also the sulphate, hydrobromate and hydrochlorate.

Pelletierīnæ Tănnas—Pelletierīnæ Tannātis—Pelletierine Tannate.—*Description and Properties.*—A yellowish, hygroscopic, odorless powder, with a pungent astringent taste. Soluble in 700 parts of water and in 80 parts of alcohol.

Dose.—1–5 grains (0.06–0.32 Gm.).

Physiological Action and Therapeutics.—Locally pomegranate is astringent. In large doses it excites vomiting, acts as a purgative, paralyzes the motor nerves, but does not affect sensation, and dilates the capillaries.

Pomegranate and its alkaloid, pelletierine, are efficient anthelmintics for tape-worm.

Like other anthelmintics, the drug should be given on an empty stomach, and if the bowels are not freely moved by the remedy, an active cathartic should follow its administration.

A decoction of the bark may be used, but, owing to the difficulty in obtaining the fresh drug, which alone possesses anthelmintic properties, the tannate of pelletierine, which is always reliable, is usually administered.

Kamāla—Kamālæ—Kamala. *U. S. P.*

(Rottlera.)

Origin.—The glands and hairs from the capsules of *Mallotus Philippinensis* (Lamarck) Mueller, Arg., a large shrub or small tree

growing wild in Australia, Eastern China, India, Southern Arabia, and Abyssinia.

Description and Properties.—A granular, mobile, brick-red or brownish-red powder, inodorous and nearly tasteless, imparting a deep-red color to alkaline liquids, alcohol, ether, or chloroform, and a pale yellow tinge to boiling water. Under the microscope it is seen to consist of stellately arranged, colorless hairs, mixed with depressed-globular glands, containing numerous red, club-shaped vesicles. It contains a resinous coloring matter, *rottlerin*, and several *resins*.

Dose.—1–2 drachms (4.0–8.0 Gm.).

Physiological Action and Therapeutics.—Kamala is a gastro-intestinal irritant and purgative, and an efficient anthelmintic against the *Tænia solium*, as well as the *Oxyuris vermicularis* and the *Ascaris lumbricoides*. The drug should be taken suspended in syrup, and followed by a full dose of castor oil.

Pēpo—Pepōnis—Pumpkin Seed. *U. S. P.*

Origin.—The seed of *Cucurbita Pepo* L., the common pumpkin, indigenous in tropical Asia and America, and cultivated throughout the temperate zones.

Description and Properties.—About ¾ inch (2 Cm.) long, broadly-ovate, flat, white or whitish, nearly smooth, with a shallow groove parallel to the edge; containing a short, conical radicle and two flat cotyledons; inodorous; taste bland and oily. It contains an *acrid resin*, supposed to be the active principle, and from 30 to 35 per cent. of a thick red fixed oil.

Dose.—1–3 ounces (32.0–94.0 Gm.).

Physiological Action and Therapeutics.—Pumpkin seed ranks next to aspidium as a remedy for the destruction of *tape-worm*, and has the advantage of being free from any disagreeable taste or unpleasant action. For administration the fresh pumpkin seeds should be beaten into a paste with powdered sugar and diluted with milk or water to about 1 pint (473.17 Cc.). Previous to its administration the patient should fast for twenty-four hours, when the bowels should be flushed out with a large saline purgative. A portion of the emulsion of pumpkin seed is then to be taken, preferably in the morning, and the balance taken in two doses at intervals of about two hours, the patient meanwhile remaining in bed to prevent, as far as possible, disturbance of the stomach.

Three or four hours after the last dose of the emulsion has been taken the patient should be given a full dose of castor oil.

GROUP XVI.—EMMENAGOGUES AND ECBOLICS.

EMMENAGOGUES are remedies which restore or increase the menstrual flow. They are divided, according to their action, into two classes. Those which act upon the uterine muscle or mucous membrane are said to be *direct;* those which influence the uterus by affecting the general health of the body, or by altering the blood-supply of the parts, or by influencing the nervous system, are said to be *indirect.*

The principal Direct Emmenagogues are—

Ergot,	Borax,
Digitalis,	Rue,
Savine,	Hydrastis,
Quinine,	Caulophyllum,
Asafetida,	Tansy,
Myrrh,	Apiol,
Guaiac,	Hedeoma.
Cantharides,	

The Indirect Emmenagogues are—

Iron and the Hematics,	Cinnamon,
Cod Liver Oil,	Aloes.
Strychnine,	

Baths { Hot foot-bath. / Hot hip-bath. / Mustard bath.

Leeches { To genitals. / To thighs.

Mustard { Baths. / Poultices to thighs. / Stupes.

ECBOLICS or OXYTOCICS are remedies which act directly upon the uterine muscular fibers, inducing uterine contraction, and are chiefly used during or immediately after parturition to produce or increase uterine action. They are therefore contraindicated before parturition, lest they induce abortion, although they are often used criminally for this purpose.

The exact manner in which ecbolics act is unknown, but it is

supposed that they act directly by stimulating the uterine center in the cord or reflexly through uterine congestion.

In small doses many of the ecbolics are emmenagogue, while many of the direct emmenagogues are ecbolic.

The only justifiable uses for ecbolics are in parturition, with uterine inertia and unobstructed and well-dilated maternal parts, when it is desired to hasten the delivery of the child, or, second, to induce firm contraction of the uterus, and thus prevent or check uterine hemorrhage after the birth of the child.

The principal Ecbolics are—

Ergot,
Ustilago,
Hydrastis,
Savine,
Quinine,
Cotton Root Bark,
Oil of Rue,
Borax,
Pilocarpine,
Potassium Permanganate,
Strong Purgatives.

Drugs which have not been considered elsewhere in the present work will now be described.

Sabīna—Sabīnæ—Savine. *U. S. P.*

Origin.—The tops of *Juniperus Sabina* L., a small evergreen procumbent or erect shrub, distributed throughout the greater portion of Europe, Siberia, Canada, and the Northern United States.

Description and Properties.—Short, thin, subquadrangular branchlets; leaves rather dark green, in four rows, opposite, scale-like, ovate-lanceolate, more or less acute, appressed, imbricated, on the back with a shallow groove containing an oblong or roundish gland; odor peculiar, terebinthinate; taste nauseous, resinous, and bitter.

It contains 2 per cent. of a *volatile oil*, tannin, resin, gum, etc.

Dose.—5–15 grains (0.3–1.0 Gm.).

Official Preparation.

Extractum Sabīnæ Flūidum—Extracti Sabīnæ Flūidi—Fluid Extract of Savine.—*Dose*, 5–15 minims (0.3–1.0 Cc.).

Ōleum Sabīnæ—Ōlei Sabīnæ—Oil of Savine. *U. S. P.*

Origin.—A volatile oil distilled from Savine.

Description and Properties.—A colorless or yellowish liquid

having a peculiar terebinthinate odor and a pungent, bitterish, and camphoraceous taste. It becomes darker and thicker by age and exposure to the air. Soluble in an equal volume of alcohol.

Dose.—1–5 minims (0.06–0.3 Cc.).

Physiological Action and Therapeutics.—The action of savine depends on the presence of the volatile oil, and this oil differs in its local external effect from the oil of turpentine merely in that the oil of savine is more active. It occasions much irritation, vesication, and even pustulation when applied to the skin. Taken internally in small doses, it produces a sensation of heat in the epigastrium, with flatulence and frequently nausea. Toxic doses excite violent gastro-enteritis.

The drug stimulates the circulation, and later, under full medicinal doses, depresses it. It is rapidly absorbed, and is excreted by various channels, increasing the urinary and bronchial excretions. These excretions, as well as the sweat and breath, smell strongly of the drug.

Savine is a decided irritant to the uterus and ovaries, inducing marked hyperemia of those organs, and promoting contractions of the pregnant uterus.

Toxic doses produce symptoms similar to those occasioned by oil of turpentine—violent gastro-enteritis, suppressed or bloody urine, great depression, etc. The treatment in poisoning by oil of savine would be full doses of Epsom salt, demulcents, anodynes, and stimulants if necessary.

Savine in the form of an ointment is used as a stimulant application to keep up the discharge from blisters. An alcoholic solution of oil of savine, 5–30 minims (0.3–1.8 Cc.) to 1 ounce (30.0 Cc.), is used in *alopecia pityroides*.

Oil of savine is a very efficient remedy in *amenorrhea*, and is also of benefit in certain cases of *menorrhagia* due to an enlarged and passively congested uterus. The hemorrhage following abortion is usually well controlled by this remedy.

The powder or fluid extract may be given, but the oil is the most effective preparation, and may be prescribed in capsules, pills, or emulsion. It should be given cautiously.

Rūta—Rūtæ—Rue. (Unofficial.)

Origin.—The leaves of *Ruta graveolens* L., an herbaceous or suffruticose perennial 2 or 3 feet (60 or 90 Cm.) high, indigenous in Southern Europe.

Description and Properties.—The leaves are ternate, the leaflets being obovate-oblong, yellowish-green, thickly dotted with minute, transparent oil-vesicles. They have a peculiar, strongly balsamic odor, and possess an aromatic, bitter, and acrid taste.

The principal constituent of rue is a *volatile oil.*

Dose.—5–20 grains (0.3–1.3 Gm.).

Ōleum Rūtæ—Ōlei Rūtæ—Oil of Rue. (Unofficial.)

Origin.—A volatile oil distilled from *Ruta graveolens* L.

Description and Properties.—A colorless or greenish-yellow liquid with the peculiar odor of the plant, and a pungent, somewhat acrid, bitterish taste. Soluble in an equal weight of alcohol.

Dose.—2–5 minims (0.13–0.3 Cc.).

Physiological Action and Therapeutics.—The action of oil of rue is analogous to that of oil of savine, though less powerful. It is used for the same purposes also, and has occasionally been employed in *hysteria.*

The oil should be administered in capsules.

Caulophyllum—Caulophylli—Caulophyllum. *U. S. P.*

(Blue Cohosh.)

Origin.—The rhizome and roots of *Caulophyllum Thalictroides* (L.) Michaux, a smooth and glaucous perennial, found in rich woodlands from Canada south to Carolina and Kentucky.

Description and Properties.—Rhizome of horizontal growth, about 4 inches (10 Cm.) long and about $\frac{1}{4}$ to $\frac{2}{5}$ inch (6 to 10 Mm.) thick, bent; on the upper side with broad, concave stem-scars and short, knotty branches; externally grayish-brown, internally whitish, tough, and woody. Roots numerous, matted, about 4 inches (10 Cm.) long and $\frac{1}{25}$ inch (1 Mm.) thick, rather tough; nearly inodorous; taste sweetish, slightly bitter, and somewhat acrid.

Caulophyllum contains an odorless, colorless, and tasteless alkaloid, *caulophyllin,* besides resins, tannin, starch, gum, etc.

Dose.—5–30 grains (0.3–2.0 Gm.).

Physiological Action and Therapeutics.—Blue cohosh is emmenagogue, antispasmodic, diuretic, and demulcent. It is quite an efficient remedy to increase the force of uterine contractions, and is of service in the treatment of *spasmodic dysmenorrhea.*

It is usually given in the form of a decoction.

Tanacētum—Tanacēti—Tansy. *U. S. P.*

Origin.—The leaves and tops of *Tanacetum vulgare* L., a perennial herb indigenous in Europe and Central Asia, and naturalized in many parts of North America.

Description and Properties.—Leaves about 6 inches (15.24 Cm.) long, bipinnatifid, the segments oblong, obtuse, serrate, or incised, smooth, dark green, and glandular; flower-heads corymbose, with an imbricated involucre, a convex, naked receptacle, and numerous yellow tubular florets; odor strongly aromatic; taste pungent and bitter.

It contains a *volatile oil* and a bitter principle, *tanacetin*, besides tannin, resin, etc.

Dose.—15–60 grains (1.0–4.0 Gm.), in infusion.

Physiological Action and Therapeutics.—In moderate doses tansy acts as an aromatic bitter. Excessive amounts produce all the symptoms of an irritant narcotic—vomiting, purging, severe abdominal pain, loss of consciousness, convulsions, and great cardiac and respiratory weakness, death usually resulting from paralysis of respiration.

The drug is regarded as an efficient remedy in *amenorrhea*, and is extensively employed in domestic practice in *hysteria* and *colic*, and topically for *bruises*, *sprains*, *muscular rheumatism*, etc.

It is used in the rural districts to promote or restore *menstruation*, and occasionally is employed with criminal intent as an abortifacient, but usually with negative results.

The drug may be given in the form of an infusion, 1 ounce to 1 pint (32.0 Gm.–473.17 Cc.), of which 1 or 2 ounces (30.0 or 60.0 Cc.) may be taken at a dose.

The oil of tansy is occasionally prescribed in doses of 1–5 minims (0.06–0.3 Cc.).

Petroselīnum—Petroselīni—Parsley.

Origin.—The root of *Petroselinum sativum* (Hoffmann), *Apium Petroselinum* L., a plant indigenous in Southern Europe, and much cultivated for culinary purposes.

Description and Properties.—The root is tapering, from 4 to 8 inches (10–20 Cm.) long, about ½ inch (12 Mm.) thick; externally yellowish or light brown; odor aromatic; taste sweetish and aromatic.

It contains a *volatile oil* and *apiol*, the chief constituent.

Dose.—30–60 grains (2.0–4.0 Gm.).

Apiŏlum—Apiŏli—Apiol (UNOFFICIAL).—*Origin.*—A camphor obtained from the fruit of *Petroselinum sativum* Hoffmann.

Description and Properties.—White needles, of a feeble, parsley odor. Insoluble in water, but freely soluble in alcohol and in ether.

Dose.—10–15 grains (0.6–1.0 Gm.).

Physiological Action and Therapeutics.—The root is carminative, laxative, and diuretic. Apiol is an active emmenagogue. Given in excessive doses, it occasions severe frontal headache, dizziness, and ringing in the ears. It causes a rapid rise of blood-pressure, due to increased cardiac action and stimulation of the vaso-motor centers.

APIOL, or Chapoteaut's APIOLINE, is usually prescribed, and is an efficient remedy in *amenorrhea*, *dysmenorrhea*, and as an anti-periodic in *malarial affections*. As an emmenagogue in cases of scanty or deficient menstruation APIOLINE is very effective.

The drug is best given in capsules, as prepared by Chapoteaut,[1] one or two capsules being taken after meals three times a day.

Hedeōma—Hedeōmæ—Hedeoma. *U. S. P.*

(PENNYROYAL.)

Origin.—The leaves and tops of *Hedeoma pulegioides* (L.) Persoon, an annual herb indigenous in North America.

Description and Properties.—Leaves opposite, short-petioled, about ½ inch (12 Mm.) long, oblong-ovate, obscurely serrate, glandular beneath; branches roundish-quadrangular, hairy; flowers in small, axillary cymules, with a tubular-ovoid, bilabiate, and five-toothed calyx, and a pale-blue, spotted, bilabiate corolla, containing two sterile and two fertile exserted stamens; odor strong, mint-like; taste warm and pungent. Its virtues depend upon a *volatile oil.*

Dose.—15–60 grains (1.0–4.0 Gm.) in infusion.

Ōleum Hedeōmæ—Ōlei Hedeōmæ—Oil of Hedeoma. *U. S. P.*

(OIL OF PENNYROYAL.)

Origin.—A volatile oil distilled from Hedeoma.

Description and Properties.—A pale-yellowish, limpid liquid, having a characteristic, pungent, mint-like odor and taste. It should

[1] M. Chapoteaut has prepared from the alcoholic solution of a petrol-ethereal extract a thick reddish liquid, to which he has given the name *Apioline.* This substance he claims to be the true active principle, and it is dispensed in capsules containing 3 minims (0.18 Cc.) each.

be kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—2–10 minims (0.1–0.6 Cc.).

Physiological Action and Therapeutics.—Hedeoma is aromatic, stimulant, carminative, and emmenagogue, while the oil is rubefacient if rubbed into the skin.

The herb is given in the form of a HOT INFUSION to bring on retarded or suspended *menstruation* and for the relief of *flatulent colic*, *pharyngitis*, *bronchitis*, etc., as well as to dissipate *congestions* of various parts.

The OIL OF HEDEOMA is an active emmenagogue, and is used to increase the rubefacient effect of various embrocations.

GROUP XVII.—ASTRINGENTS.

ASTRINGENTS are medicines which cause the contraction of living tissues, diminishing the amount of blood or other fluid in them, and reducing hemorrhage, or, through their constipating action, limiting the intestinal secretions as well as those from mucous membranes generally.

They act chemically upon the tissues, and, when taken internally, their influence is similar to that of tonics, invigorating the various structures of the body, their principal use being, in cases of relaxed conditions of the muscles and fibers or of the mucous membranes characterized by excessive secretion.

Astringents are more or less irritating, and should therefore not be employed, as a rule, in acute inflammatory conditions. There are, however, four exceptions—lead acetate or subacetate, bismuth subnitrate or subcarbonate, cerium oxalate, and silver nitrate—which are sedative astringents and would be indicated in acute inflammatory states.

Astringents vary in the intensity of their action, their strength being directly proportionate to the condensation of tissue. Herein lies the chief difference between astringents and caustics. If the heavy metals be arranged according to their astringent properties, the feeblest at one extreme and the strongest at the other, it will be observed that the least astringent is the most caustic, and the most astringent the least caustic, the order being as follows: lead (*astringent*), iron, zinc, copper, silver, tin, mercury (*caustic*), lead being the most astringent and least caustic, and mercury the most caustic and least astringent.

The explanation of these diverse properties is that the astringents expel the fluid from the protoplasm, contracting or constringing the tissue and causing it to occupy less space; whereas the caustics relax the eschar, reducing the space it occupies. The caustic action of a mineral salt depends both upon the nature of the base and the acid radical. In other words, the salt and the products of its action must both be somewhat soluble in water, otherwise the eschar will be firm, and the drug will therefore act as an astringent.

The chlorides of the heavy metals are usually soluble, and are generally the more caustic, as, for instance, zinc chloride, mercuric chloride (corrosive sublimate), etc. Should a chloride be insoluble in water, it will not act as a caustic—as, for example, the insoluble, and consequently inert, silver chloride.

Certain drugs which in a concentrated state are caustic are, if sufficiently diluted, astringent, as is the case with sulphuric acid.

An astringent drug employed to check hemorrhage is called a *styptic*, the subsulphate of iron being extensively used as such.

Astringents differ in some respects from other groups of medicines, in that they do not, as a rule, assist one another by combination. They are divisible into—(1) Vegetable astringents; (2) mineral astringents. The vegetable astringents mentioned in this group, beginning with the type, are—

Tannic Acid,	Kino,	Rhus Glabra,
Gallic Acid,	Krameria,	Rosa Gallica,
Galla,	Hematoxylon,	Rubus.
Quercus Alba,	Hamamelis,	
Catechu,	Geranium,	

Cinnamon also possesses considerable astringent properties, but is classed among the Aromatics.

The mineral astringents, beginning with the type, are—

Lead,	Silver,	Bismuth,
Zinc,	Alum,	Cerium Oxalate.
Copper,		

Certain salts of iron are powerfully astringent, although classed with iron under the Restoratives. Diluted sulphuric and nitric acids also possess marked astringent properties. (See Mineral Acids.)

Antagonists and Incompatibles.—The vegetable astringents are incompatible with the salts of iron (ferric and ferrous), and also with the salts of lead, silver, antimony, and copper; with the alka-

loids, the glucosids, and gelatin; and with the alkalies and mineral acids and emulsions. Spirit of nitrous ether is incompatible with gallic acid.

Synergists.—Tonics and bitters, and also agents increasing waste, favor the action of vegetable astringents.

VEGETABLE ASTRINGENTS.

Ăcidum Tănnicum—Ăcidi Tănnici—Tannic Acid. *U. S. P.*

Origin.—An organic acid obtained from Nutgall.

Description and Properties.—A light-yellowish, amorphous powder, usually cohering in the form of glistening scales or spongy masses; odorless or with a faint characteristic odor and a strongly astringent taste; gradually turning darker when exposed to air and light. Soluble in about 1 part of water and in 0.6 part of alcohol; very soluble in boiling water and in boiling alcohol; also soluble in about 1 part of glycerin with the assistance of a moderate heat; freely soluble in diluted alcohol and sparingly in absolute alcohol; almost insoluble in absolute ether, chloroform, benzol, or benzin.

Dose.—1–20 grains (0.06–1.2 Gm.).

Official Preparations.

Collŏdium Stўpticum—Collŏdii Stўptici—Styptic Collodion.—Used externally and locally. (Tannic Acid, 20; Alcohol, 5; Ether, 25; Collodion, to 100.)

Glycerītum Ăcidi Tănnici—Glycerīti Ăcidi Tănnici—Glycerite of Tannic Acid.—Used externally and locally. (Tannic Acid, 20; Glycerin, 80.)

Trochĭsci Ăcidi Tănnici—Trochĭscos (acc.) **Ăcidi Tănnici—Troches of Tannic Acid.**—*Dose*, 1 to 3 troches.

Unguĕntum Ăcidi Tănnici—Unguĕnti Ăcidi Tănnici—Ointment of Tannic Acid.—Used externally and locally. (Tannic Acid, 20; Benzoated Lard, 80.)

Physiological Action.—*Externally.*—Tannic acid has little if any effect upon the unbroken skin. Upon raw surfaces, however, it acts as a powerful astringent, contracting the tissues and coagulating the albumin. Urticaria and erythema sometimes follow its use.

Internally.—Digestive System.—By coagulating the albumins tannic acid imparts a dryness to the mouth, accompanied by a sensation of puckering. It partially paralyzes the sensory nerve-endings, thus blunting the sense of taste. Large doses produce vomiting by an irritant action, while diarrhea, followed by constipation, may be present.

By its action on the stomach pepsin is precipitated, albumin coagulated, and the secretion of gastric juice diminished, all of which actions tend to impair the digestive function. There is a partial conversion of the tannic acid into gallic and pyrogallic acids. To facilitate absorption there must be a preliminary conversion of tannic into gallic acid, and this reaction takes place in the intestine. A diminution of peristalsis is followed by constipation.

Circulatory System.—Its astringent property makes tannic acid a valuable hemostatic. It arrests hemorrhage by contracting the blood-vessels. The blood absorbs it as gallic acid, and is not affected by it.

Nervous System.—No special effect has been observed.

Respiratory System.—Save in arresting hemorrhage of the lungs, no influence is known.

Absorption and Elimination.—Being absorbed as gallic acid, the kidneys eliminate it in that form. A doubtful action ascribed to it by some authorities is that of diminishing albuminuria.

Uterus.—No special influence other than arresting hemorrhage has been noted.

Untoward Action.—A dose of 3 grains (0.2 Gm.) may cause pain in the stomach and intestines. Following such a dose, there may be coating of the tongue, thirst, eructation of gas, and tenesmus. A tendency to hemorrhoidal congestion is enhanced.

Therapeutics.—*Externally and Locally.*—TANNIC ACID is a valuable application for *bed-sores* and *ulcers*. Its astringent property is of use in cases of *intertrigo*, *impetigo*, *sycosis*, *sore nipples*, and *eczema* of the *chronic*, *desquamating variety*. It is beneficial in *hyperidrosis* of the *hands* and *feet*, of the *axillæ* and *genitals*. A solution of the acid has been found of advantage in *erysipelas* and *lymphangitis*.

The GLYCERITE OF TANNIN, applied locally in cases of *otorrhea* and *ozena* as sequelæ of scarlet fever or measles, is of great benefit. The same preparation or a powder may be used in *stomatitis*, *tonsillitis*, and *pharyngitis*, as well as in cases of *spongy* or *ulcerous gums*. The LOZENGES are beneficial in *whooping cough*. SUPPOSITORIES OF TANNIC ACID are employed for *hemorrhoids*, *fissure*, *prolapse*, and *rectal ulcers*.

An AQUEOUS SOLUTION OF TANNIC ACID is very useful in *leucorrhea*. The glycerite and iodoform tannin are excellent agents in *inflammation of the cervix uteri*. TANNIC ACID also dispels the odor and allays the discharges in *carcinoma uteri*, being applied as a

vaginal douche. It is useful as a lotion in *herpes* and *alopecia circumscripta.* Injection of the acid or insufflation of the powder into the urethra is of some value in *gonorrhea.* In *hemoptysis* an aqueous solution (5–10 grains to the ounce of water) may be used as a spray. In *acute dysentery* much benefit may be derived from an enema of 10 grains of tannin added to a 4 per cent. solution of boric acid. It lessens pain and tenesmus and controls hemorrhage.

Internally.—For other than local action gallic is preferable to tannic acid, the latter not being absorbable. TANNIC ACID is styptic in *hematemesis* and *intestinal hemorrhage* and checks *diarrhea.* It forms tannates when given as an antidote for poisoning by alkaloids and tartar emetic. Since these tannates are more or less soluble, however, some drug should be given as a purgative.

Contraindications.—From comparative absorbability of tannic and gallic acids the former is preferable for local, the latter for systemic, effects.

Administration.—For hematemesis powders of 10–20 grains are given. For effect upon the intestines it should be administered in pills, 3–5 grains, or it may be dissolved in the stomach. Locally it may be applied as a solution, glycerite, powder, suppository, or an ointment. Styptic collodion is a protection to lacerated or incised wounds.

Ăcidum Găllicum—Ăcidi Găllici—Gallic Acid.
U. S. P.

Origin.—An organic acid usually prepared from Tannic Acid.

Description and Properties.—White or pale fawn-colored, silky, interlaced needles or triclinic prisms; odorless, having an astringent or slightly acidulous taste; permanent in the air. Soluble in 100 parts of water and in 5 parts of alcohol.

Dose.—5–20 grains (0.3–1.2 Gm.).

Physiological Action.—Gallic acid resembles tannic acid in its action, but does not coagulate albumin, and therefore does not possess the local influence of the latter. It is eliminated by the kidneys as gallic acid.

Therapeutics.—*Externally and Locally.*—Gallic acid is seldom used externally. Locally, tannic acid is preferable, but gallic acid is effectual applied as a glycerite, 1 drachm–1 ounce (4.0–32.0 Gm.), in cases of *tonsillitis* and *pharyngitis.* Gallic acid and stramonium ointment in equal parts form an unguent for *hemorrhoids.* In alcoholic solution it is applied to the membrane of *diphtheria.*

Internally.—Gallic acid is chiefly serviceable in *hemorrhage from the stomach, intestines, lungs,* and *kidneys,* It is employed in *menorrhagia,* but ergot is better. It reduces albumin in some forms of *Bright's disease,* and is useful in checking *excessive sweating* and *bronchorrhea.* In *chronic phthisis* it relieves the *night-sweats* and reduces *profuse expectoration. Cystitis, dysentery,* and *chronic diarrhea* are benefited by its use. It checks suppuration and stays the progress of *pyelitis* and *pyelo-nephritis.* Used in conjunction with opium, it has been found beneficial in *diabetes insipidus.*

PYROGALLIC ACID is of use in *acne,* but produces a discoloration of the skin.

PYROGALLOL, 2 grains (.12 Gm.), is used in *internal hemorrhage.* As an ointment, 1 drachm–1 ounce (4.0–32.0 Gm.), it is palliative in *psoriasis,* and it is also beneficial in *lupus* and *epithelioma.*

GALLANOL, the analid of gallic acid, is a bactericide, and is useful in *psoriasis* in the form of a powder or in an ointment (1 to 30). It is also used in alcoholic solutions of 10 per cent. strength. It relieves the *pruritus of chronic eczema.* In *favus* and *tricophytosis* a mixture is used consisting of gallanol 10 parts, ammonia 1 part, and alcohol 50 parts.

GALLICINE, methyl ether of gallic acid, applied in finely divided form with a brush, is of benefit in *keratitis* and *conjunctivitis,* as well as in *eczema of the eyelids.*

Administration.—Gallic acid is not to be combined with iron. It is administered in powder or pill form. The glycerite and the ointment are used locally.

Gălla—Gallæ—Nutgall. *U. S. P.*

Origin.—An excrescence on *Quercus Lusitanica* Lamarck, caused by the punctures and deposited ova of *Cynips gallæ tinctoriæ* Olivier.

Quercus Lusitanica is a small tree, or oftener a shrub, 4 to 6 feet (1.2–1.8 M.) high, indigenous in the basin of the Mediterranean.

Description and Properties.—Nutgalls are subglobular, about 1 inch (25 Mm.) in diameter, more or less tuberculated above, otherwise smooth, heavy, hard; often with a circular hole near the middle communicating with the central cavity containing either the partly developed insect or pulverulent remains of it; inodorous; taste strongly astringent.

Galla in substance is seldom given internally.

Official Preparations.

Tinctūra Gallæ—Tinctūræ Gallæ—Tincture of Nutgall.—*Dose*, 1 to 2 fluidrachms (4.0–8.0 Gm.).

Unguĕntum Gălla—Unguĕnti Gallæ—Ointment of Nutgall.—Used externally.

Physiological Action.—Its action is that of tannic acid, which is derived from galls.

Therapeutics.—*Externally and Locally.*—GALLA, in combination with stramonium liniment or 1 drachm (4.0 Gm.) of powdered opium to each ounce (32.0 Gm.) of nutgall ointment, is an excellent application for *external hemorrhoids.* For *eczema of the scalp, herpes, fissured nipples, indolent ulcers*, and *chilblains* nutgall ointment has proved beneficial, as well as for *alopecia circumscripta* and *rectal prolapse.* One part of powdered galls to seven or eight of vaseline is a most excellent application for lessening the cicatricial contraction following extensive *burns.* Galla is used little locally, but is recommended as a gargle and wash, being applied to the relaxed mucous membranes of the mouth, vagina, and rectum.

Internally.—Tannic and gallic acids are preferable in *severe diarrhea* and *dysentery*, an infusion or decoction being used as an enema.

Administration.—Galls are used mostly in the form of an infusion or ointment. The tincture is seldom employed.

Quĕrcus Ălba—Quĕrcus Ălbæ—White Oak.

U. S. P.

Origin.—The bark of *Quercus alba* L. The oaks are shrubs or trees growing chiefly in the temperate zone, often forming extensive forests. The white oak is a stately tree, 60 to 80 feet (18–24 M.) high, found from Canada to Florida and west to Wisconsin and Eastern Texas.

Description and Properties.—In nearly flat pieces deprived of the corky layer, about $\frac{1}{5}$ inch (5 Mm.), pale brown; inner surface with short, sharp, longitudinal ridges; tough and of a coarse, fibrous fracture, a faint, tan-like odor, and a strongly astringent taste. As found in the shops, it is usually an irregularly coarse fibrous powder, which does not tinge the saliva yellow.

Dose.—Seldom given in substance. A decoction is sometimes given internally, but the chief use of the drug is for external or local application.

Physiological Action.—The general action is that of tannic acid.

Therapeutics.—*Externally and Locally.*—It is used for *chapped nipples*, *gangrene*, *ulcers*, and *dermatitis venenata*. It is of value as an ointment in *hemorrhoids*, *prolapsus ani*, *anal fissure*, and *leucorrhea*. The drug is also serviceable in *relaxed uvula* and as a *tooth-powder*. It stains the linen, however, which somewhat limits its use. Pessaries made of the bark have been used to check *uterine hemorrhage*. For *hernia* the concentrated fluid extract is injected into the tissues for the purpose of exciting inflammation and consequent contraction of the hernial ring.

Internally.—It reduces *bronchial discharge*, *hemoptysis*, *serous diarrhea*, and *dysentery*.

Administration.—Externally it is used as a poultice—chiefly in the form of the powdered bark. The decoction is employed almost exclusively as an injection and for internal administration. The laity were formerly wont to roast the acorns and chew them, or grate them and mix the gratings with cocoa or chocolate, believing them to be a cure for diarrhea as well as for flatulent dyspepsia and scrofula.

Cătechu—Cătechu—Catechu. *U. S. P.*

Origin.—An extract prepared from the wood of *Acacia catechu* (Linn. fil.) Willd., a tree 30 to 40 feet (9–12 M.) high, indigenous in the East Indies and Ceylon.

Description and Properties.—Occurring in irregular masses, containing fragments of leaves; dark-brown, brittle, somewhat porous and glossy when freshly broken. It is nearly inodorous and has a strongly astringent and sweetish taste.

Dose.—10–30 grains (0.6–2.0 Gm.).

Official Preparations.

Tinctūra Cătechu Compŏsita—Tinctūræ Cătechu Compŏsitæ—Compound Tincture of Catechu.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.). (Catechu, 100; Cassia Cinnamon, 50; by maceration and percolation with Diluted Alcohol to 1000.)

Trochĭsci Cătechu—Trochĭscos (acc.) **Cătechu—Troches of Catechu.**—*Dose*, 1 to 6 troches. (Each troche contains 1 grain (0.06 Gm.) of catechu.)

Physiological Action.—Catechu does not differ in its action from tannic acid. It is to be preferred to kino, however, since its operation is more enĕrgetic.

Therapeutics.—*Externally and Locally.*—Though used but little externally, it is a very efficient remedy for *ulcerated nipples*

and *chronic ulcers*, the form employed being that of a lotion, used either alone or in combination with copper sulphate or alum. Catechu is of service in constringing relaxed tissues, and is used as a mouth-wash in *spongy gums*, *ptyalism*, and *relaxation of the uvula*. It is also of use as a gargle in *pharyngitis* and *chronic sore throat* of public speakers and users of tobacco. In *gonorrhea* and *leucorrhea* an injection of 2–3 drachms (8.0–12.0 Gm.) of the tincture in 5–6 ounces (160.0–192.0 Gm.) of water is beneficial.

Catechu has been used by persons suffering from *pyrosis*. It is claimed that chewing a small pellet of the drug diminishes the coating of mucus on the mucous membrane of the stomach. It is applied to *aphthæ* in *stomatitis*.

Internally.—Its prevailing use is in chronic serous *diarrheas*, but the administration must be preceded by a saline purge in order to secure the fullest effect. Catechu checks *uterine hemorrhage* and the secretions in *bronchitis* and *chronic phthisis*.

Administration.—The troche is best used in chronic pharyngitis and relaxed buccal mucous membranes, or a piece of the drug may be chewed with beneficial results. For diarrhea the compound tincture, with a little morphia or the official chalk mixture, is the best form for use.

Kīno—Kīno—Kino. *U. S. P.*

Origin.—The inspissated juice of *Pterocarpus marsupianum* Roxburgh, a tree (called *buja* in Bengal) 60 to 80 feet (18–24 M.) high, indigenous in India and Ceylon.

Description and Properties.—Small, angular, dark brownish-red and transparent; inodorous, very astringent and sweetish, coloring the saliva deep red. Soluble in alcohol, nearly insoluble in ether, and only slightly soluble in cold water.

Dose.—10–20 grains (0.6–1.2 Gm.).

Official Preparation.

Tinctūra Kīno—Tinctūræ Kīno—Tincture of Kino.—*Dose*, ¼–2 fluidrachms (1.0–8.0 Cc.).

Physiological Action.—Its action is similar to that of tannic acid. It colors the saliva red.

Therapeutics.—*Externally and Locally.*—Kino is an efficient dressing for *flabby, indolent ulcers*, acting as a stimulant. Yet the other astringents deserve precedence. As a gargle in *pharyngitis* and *relaxed uvula* kino is valuable, but, owing to its disagreeable

taste, krameria is to be preferred. Owing to its speedy action, it checks the hemorrhage in *epistaxis* where other astringents fail. In *leucorrhea* and *gonorrhea* an infusion or injection is serviceable.

Internally.—In the *polyuria of diabetes,* in *menorrhagia,* the *sweating of phthisis,* and *pyrosis* it has been used to some advantage; also in *dysentery* and *chronic diarrheas* with profuse serous discharges. It is less irritating than the other astringents.

Administration.—The powder is used as an insufflation in epistaxis, and is dusted on ulcers. In diarrhea it is best to use kino in combination with opium or chalk mixture. The tincture is used internally.

Kramēria—Kramēriæ—Krameria. *U. S. P.*

(Rhatany.)

Origin.—The root of *Krameria triandra* Ruiz et Pavon, and of *Krameria ixina* L., a low shrub with spreading branches, native to Bolivia and Peru, growing in sandy localities in the mountains at an altitude of 3000 to 8000 feet (900–2440 M.).

Description and Properties.—From 1 to 1½ inches (25–38 Mm.) thick, knotty and several-headed above, branched below, the branches long; bark smooth, or in the thinner pieces scaly, deep rust-brown, $\frac{1}{25}$–$\frac{1}{12}$ inch (1–2 Mm.) thick, very astringent, inodorous; wood pale, brownish-red, tough, with fine medullary rays, nearly tasteless. The root of *Krameria ixina* (Savanilla rhatany) is less knotty and slenderer, and has a dark purplish-brown bark about $\frac{1}{8}$ inch (3 Mm.) thick.

Dose.—8–30 grains (0.5–2.0 Gm.).

Official Preparations.

Extrăctum Kramēriæ—Extrăcti Kramēriæ—Extract of Krameria.—*Dose,* 5–10 grains (0.3–0.6 Gm.).

Extrăctum Kramēriæ Flūidum—Extrăcti Kramēriæ Flūidi—Fluid Extract of Krameria.—*Dose,* 5–30 minims (0.3–2.0 Cc.).

Tinctūra Kramēriæ—Tinctūræ Kramēriæ—Tincture of Krameria.—*Dose,* ½–2 drachms (2.0–8.0 Cc.).

Trochĭsci Kramēriæ—Trochĭscos (acc.) **Kramēriæ—Troches of Krameria.**—*Dose,* 1 to 5 troches. (Each troche contains 1 grain (0.06 Gm.).

Sўrupus Kramēriæ—Sўrupi Kramēriæ—Syrup of Krameria.—*Dose,* ½–4 fluidrachms (2.0–16.0 Cc.).

Physiological Action.—The action of krameria is identical with that of tannic acid.

Therapeutics.—*Externally and Locally.*—Its value as a topical application is of little consequence, but it has served satisfactorily

as an ointment for *hemorrhoids*. It is used as an infusion or injection of the diluted tincture or fluid extract in *leucorrhea*, *gleet*, and especially in *anal fissure*, for which it has been highly recommended, since it checks the accumulation of feces in the rectum by constricting its walls, rendering defecation less painful and preventing the formation of ulcers. The powder is used in *epistaxis* and *rectal bleeding*, also in *prolapsus ani* and *ozena* of a non-specific nature. It is used extensively in the preparation of tooth-powders, being especially beneficial where the gums display a tendency to bleed readily. A mouth-wash and gargle are used in *ptyalism*, *spongy gums*, *pharyngitis*, and *relaxation of the uvula*.

Internally.—Krameria has gained a wide reputation for allaying habitual, but not profuse, *uterine hemorrhage*. It may be used to check intestinal *hemorrhages*, *hematuria*, *hematemesis*, and *hemoptysis*, but the other astringents are preferable. It is a good tonic for debilitated patients. It is also used in *chronic diarrhea* and *dysentery* and in *incontinence of urine*.

Administration.—The powder is used in the nose and rectum either by insufflation or by means of a pledget of cotton. As an injection and enema the fluid extract is used. In fissure of the anus the rectum must be emptied first by an enema; then a solution of the extract, 1 drachm (4.0 Gm.) to 1 ounce (30.0 Cc.) of water, is emptied into the bowel and allowed to run out, repeating the process several times. This procedure is very painful at first, but as the fissure gradually heals the operation will cause the patient little if any pain. Keep the bowels open with a mild saline laxative. The success attending the operation warrants any discomfort which the patient may experience. The nasal douche is best in ozena, followed by an insufflation of the powder.

Hæmatŏxylon—Hæmatŏxyli—Hæmatoxylon.

U. S. P.

(Logwood.)

Origin.—The heart-wood of *Hæmatoxylon Campechianum* L., a tree 30 to 40 feet (9–12 M.) high, indigenous on the shores of the Gulf of Campeachy and in certain parts of South America.

Description and Properties.—Heavy, hard, externally purplish-black, internally brownish-red, marked with concentric circles, splitting irregularly; odor faint, agreeable, taste sweetish, astringent. When chewed it colors the saliva dark pink.

Only the preparations of Hæmatoxylon are used internally.

Official Preparation.

Extractum Hæmatoxyli—Extracti Hæmatoxyli—Extract of Hæmatoxylon.—*Dose*, 5–15 grains (0.3–1.0 Gm.).

Physiological Action.—Its astringent properties are due to the tannin which hæmatoxylon contains.

Therapeutics.—*Externally and Locally.*—It is a valuable antiseptic, as well as a healing application in *gangrene* and *foul-smelling sores*. It is also beneficial as an injection in *leucorrhea*.

Internally.—Hæmatoxylon has a very agreeable, sweetish taste; hence it is well taken by children. It is of marked benefit in *infantile diarrhea*, but has the disadvantage of coloring the discharges and diaper blood-red or purplish blue, causing much alarm to the mother. The urine is also colored. It arrests *internal hemorrhage* and *sweating*, and is also used in *dysentery*, *tuberculous diarrhea*, and *atonic dyspepsia*. Some authorities claim that hæmatoxylon causes phlebitis.

Administration.—In diarrhea a decoction with a little aromatic sulphuric acid is the best preparation. To it may be added a little syrup of ginger and camphorated tincture of opium. The decoction is, in fact, the best preparation to use.

Hamamēlis—Hamamĕlidis—Hamamelis. *U. S. P.*

(WITCH-HAZEL.)

Origin.—The leaves of *Hamamelis Virginica* L., a shrub 6 to 10 feet (1.8–3.0 M.) high, growing in damp woods and thickets in Canada and the United States.

Description and Properties.—Short-petiolate, about 4 inches (10 Cm.) long, obovate or oval, slightly heart-shaped and oblique at the base, sinuate-toothed, thickish, nearly smooth, inodorous; taste astringent and bitter.

Official Preparation.

Extractum Hamamĕlidis Flŭidum—Extracti Hamamĕlidis Flŭidi—Fluid Extract of Hamamelis.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Physiological Action.—The action of tannic acid is also that of hamamelis, save that the latter has a somewhat different influence upon the circulation.

Circulatory System.—Hamamelis acts on the muscular fibers of the veins, the *modus operandi*, however, not being satisfactorily determined. Large doses produce severe throbbing headache.

Therapeutics.—*Externally and Locally.*—For *sprains* and *bruises* hamamelis is a favorite application, although some authorities regard it merely as a placebo. Locally, the FLUID EXTRACT, with the addition of one-third its volume of glycerin, has been used in *urticaria*, *rhus-poisoning*, and *phlegmasia dolens*. Owing to its marked sedative properties, HAMAMELIS OINTMENT is extremely beneficial in *varicose ulcers*, *eczema*, *herpes*, *seborrhea*, and *acne rosacea*, as well as in checking excessive secretions. It is also efficient in *carbuncle*, *freckles*, *hyperidrosis*, *lupus erythematosus*, *burns*, and *frost-bites*.

The local action of the drug is important. The DISTILLED EXTRACT, diluted with alcohol or water, is applied to *inflamed gums*, the nasal mucous membrane after removal of *polypi*, and in *pharyngitis* as a spray. As a SUPPOSITORY or applied by means of a piece of cotton or wool soaked with the FLUID EXTRACT, hamamelis affords a most grateful relief in *bleeding piles*, especially the internal variety. In *cystitis* and *hemorrhage from the bladder* an injection of the diluted FLUID EXTRACT or DISTILLED EXTRACT is very valuable, besides being a most reliable topical application in *capillary hemorrhage* from wounds, *epistaxis*, and *bleeding* after extraction of teeth. The OINTMENT is used in *rectal fissures and ulcers*, and the LOTION has been employed to some extent in *chronic rheumatism*, since it relieves the pain and stiffness in the muscles and joints. The DECOCTION, with a little boric acid and a 1 per cent. solution of creasote, has been recommended as a *gonorrheal* injection.

Internally.—Given internally, hamamelis enhances the results obtained by the local application in *bleeding piles*, *leucorrhea*, and *gonorrhea*, and, owing to its peculiar action upon the veins, in *varicose veins*. It lessens the pain of *dysmenorrhea*, while by its use in *menorrhagia* the flow is remarkably diminished. It is highly beneficial in *internal hemorrhages*, *hemoptysis*, *hematuria*, *hematemesis*, and especially in *uterine hemorrhages*. It reduces suppuration in *pyelitis* and the excessive morbid discharge in *chronic bronchitis*. It is a valuable remedy in *purpura hæmorrhagica*, *chronic enteritis*, *diarrhea*, *dysentery*, and *varicocele*. Hamamelis also prevents *abortion*.

Administration.—The best preparation, both for internal and external use, is the distilled extract, although it is not official. The ointment and lotion are used externally, and the fluid extract internally. The preparations of hamamelis to be found in drug-stores are unreliable unless they be perfectly fresh. Some of the

proprietary preparations are concocted with extreme care and accuracy, and are often much more efficient than the official articles which have been standing in the shops for a long while, possibly exposed to the air.

Gerānium—Gerānii—Geranium. *U. S. P.*

(CRANESBILL.)

Origin.—The rhizome of *Geranium maculatum* L., a perennial herb with a stem 2 to 3 feet (30–60 Cm.) high, very common in Canada and the United States westward as far as Kansas.

Description and Properties.—Growth horizontal, cylindrical, 2 to 3 inches (5–7 Cm.) long and about ½ inch (1 Cm.) thick; rather sharply tuberculated, longitudinally wrinkled, dark brown; bark thin; wood-wedges yellowish, small, forming a circle near the cambium line; medullary rays broad, central pith large; roots thin, fragile, inodorous; taste strongly astringent.

Dose.—20–40 grains (1.2–2.40 Gm.).

Official Preparation.

Extractum Gerānii Flūidum—Extracti Gerānii Flūidi—Fluid Extract of Geranium.—*Dose*, 20–40 minims (1.2–2.40 Cc.).

Physiological Action.—The action of geranium corresponds with that of tannic acid.

Therapeutics.—*Externally and Locally.*—Geranium is not used externally. Its local action is varied. It is serviceable as an astringent gargle in *sore throat;* as a mouth-wash in *aphthous stomatitis;* in *relaxed conditions* of the rectum, vagina, and throat; in *buccal ulcer*, *metrorrhagia*, and *anal fissure;* in *prolapsus ani* and *epistaxis*. It has also proved valuable as an injection in *leucorrhea*, *gonorrhea*, and *gleet*.

Internally.—Owing to its agreeable taste, it is useful in *infantile diarrhea* and for persons having weak stomachs. In the early stages of *phthisis* it is very beneficial, as it reduces the fever and pulse-rate, at the same time checking the *night-sweats*, *cough*, *expectoration*, and *hemoptysis*. Under it the patient's appetite improves and he gains in weight. The fluid extract, in combination with an aromatic, gives perceptible temporary relief in *rapid acute phthisis* attended with severe, distressing cough and debilitating night-sweats. It has also been used to advantage in *internal hemorrhages*.

Administration.—Locally, the powdered root and fluid extracts are used, but the fluid extract diluted with water is preferable. For an injection a decoction, 1 ounce (32.0 Gm.) to 1–2 pints (512.0–1024.0 Gm.) of water, is used, and the decoction in milk is of service in infantile diarrhea. Prof. Johnson claims that geranium contains mucilaginous material which, acting as a demulcent, makes the decoction a much more desirable preparation than a simple solution of tannin.

Rhŭs Glābra—Rhōis Glābræ—Rhus Glabra. *U. S. P.*

(SUMACH.)

Origin.—The fruit of *Rhus glabra* L., a shrub or suffruticose plant about 12 feet (3.6 M.) high, growing in rocky or barren soil in North America.

Description and Properties.—Subglobular, about $\frac{1}{8}$ inch (3 Mm.) in diameter, drupaceous, crimson, densely hairy, containing a roundish-oblong, smooth putamen; inodorous; taste acidulous.

Dose.—The preparations only are used internally.

Official Preparation.

Extrăctum Rhōis Glābræ Flūidum—Extrăcti Rhōis Glābræ Flūidi—Fluid Extract of Rhus Glabra.—*Dose*, $\frac{1}{4}$-1 fluidrachm (1.0–4.0 Cc.).

Allied Species.

Rhŭs Aromătica—Rhois Aromăticæ—Sweet Sumach.

Unofficial Preparation.

Extrăctum Rhōis Aromăticæ Flūidum—Extrăcti Rhōis Aromăticæ Flūidi—Fluid Extract of Rhus Aromatica.—*Dose*, 5 minims–1 fluidrachm (0.3–4.0 Cc.).

Physiological Action.—The action of Rhus glabra resembles that of tannic acid.

Therapeutics.—*Externally and Locally.*—An INFUSION or the FLUID EXTRACT is used as a topical application for *ulcers* and *inflamed wounds*. The INFUSION is an excellent mouth-wash in *spongy gums*, *ptyalism*, *pharyngitis*, *aphthous stomatitis*, and *tonsillitis*. It can be used alone, but is much more efficient when combined with potassium chlorate and glycerin, adding a little menthol, 2–3 grains (.12–.20 Gm.), to make the mixture more agreeable. It is also of service as an injection in *leucorrhea*.

Internally.—Rhus glabra acts well in staying *incontinence of urine* and *hematuria*. A dose of 10–30 drops of the FLUID EXTRACT,

taken two or three times daily, has produced complete temporary suspension of *nocturnal eneuresis* of children, as well as *senile eneuresis.*

Administration.—The fluid extract is used exclusively.

Rōsa Gallica—Rōsæ Gallicæ—Red Rose. *U. S. P.*

Origin.—The petals of *Rosa gallica* L., collected before expanding.

Description and Properties.—Usually occurring in small cones consisting of numerous imbricated, roundish, retuse, deep purple-colored, yellow-clawed petals, having a roseate odor and a bitterish, slightly acidulous, and distinctly astringent taste.

Official Preparations.

Confectio Rōsæ—Confectiōnis Rōsæ—Confection of Rose.—Used as an excipient in pill masses.

Extractum Rōsæ Flūidum—Extracti Rōsæ Flūidi—Fluid Extract of Rose.—Used chiefly as a vehicle.

Physiological Action.—It acts like tannic acid.

Therapeutics.—*Externally and Locally.*—The OINTMENT is used for *chapped lips* and *hands*, and also for *superficial burns* and in *erythema.*

The FLUID EXTRACT is used as an application to *inflamed eyes*, *buccal*, *aural*, and *anal ulcers*, and in *aphthous stomatitis.* It has been employed in conjunction with sodium salicylate to prevent the *pitting of small-pox.* Its chief use, however, is as a vehicle and flavoring extract.

Internally.—It is practically of but little value as an internal agent, although it exerts some action in *checking profuse sweats* and in *uterine hemorrhages.*

Administration.—The fluid extract is mainly used, an infusion of which is given internally. The fresh leaves, crushed, are serviceable as a poultice.

Rūbus—Rūbi—Blackberry. *U. S. P.*

Origin.—The root-bark of *Rubus villosus* Ait., *Rubus Canadensis* L., and *Rubus trivialis* Mx., common shrubby North American plants.

Description and Properties.—Thin, tough, flexible bands, outer surface blackish or blackish-gray, inner surface pale-brownish, some-

times with strips of whitish, tasteless wood adhering; inodorous; taste strongly astringent, somewhat bitter.

Official Preparation.

Extractum Rubi Fluidum—Extracti Rubi Fluidi—Fluid Extract of Rubus.—*Dose*, ½–2 fluidrachms (2.0–8.0 Cc.).

Physiological Action.—Identical with that of tannic acid.

Therapeutics.—*Internally.*—The fluid extract is used in the *summer diarrhea* of children—practically its only employment. An infusion of the leaves is claimed by Popoff to be an excellent remedy for *debility of the bladder.*

Administration.—The fluid extract and the infusion are used as medicinal agents. The syrupus rubi idæi is used only as a vehicle. Blackberry cordial and blackberry brandy are favorite modes of administration. It is commonly believed by the laity that the various blackberry and raspberry preserves are efficacious as remedies; on the contrary, they are highly irritating, because of the seeds present in them.

MINERAL ASTRINGENTS.

Plumbum—Plumbi—Lead.

The salts of lead only are used in medicine.

Plumbi Acetas—Plumbi Acetatis—Lead Acetate. *U. S. P.*

(Sugar of Lead.)

Origin.—Metallic Lead is dissolved, in the presence of air, in Acetic Acid, or Lead Oxide is dissolved by the aid of a gentle heat in Acetic Acid and Water, the solution being filtered, evaporated, and crystallized.

Description and Properties.—Colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, or granular crystals, having a faintly acetous odor and a sweetish, astringent, and afterward metallic taste. On exposure to the air efflorescent and absorbing carbon dioxide. Soluble in 2.3 parts of water and in 21 parts of alcohol, in 0.5 part of boiling water, and in 1 part of boiling alcohol. Lead acetate should be kept in well-stoppered bottles.

Dose.—½–5 grains (0.03–0.3 Gm.).

Official Preparations.

Līquor Plŭmbi Subacetātis—Liquōris Plŭmbi Subacetātis—Solution of Lead Subacetate (GOULARD'S EXTRACT).—Used externally and locally. (The solution contains about 25 per cent. of Lead Subacetate.)

Līquor Plŭmbi Subacetātis Dilūtus—Liquōris Plŭmbi Subacetātis Dilūti—Diluted Solution of Lead Subacetate (LEAD WATER).—Used externally and locally. (It contains 3 per cent. of Lead Subacetate.)

Cerātum Plŭmbi Subacetātis—Cerāti Plŭmbi Subacetātis—Cerate of Lead Subacetate (GOULARD'S CERATE).—Used externally and locally. (Goulard's Extract, 20; Camphor Cerate, 80 parts.)

Unofficial Preparation.

Liniměntum Plŭmbi Subacetātis—Liniměnti Plŭmbi Subacetātis—Liniment of Lead Subacetate.—Used externally and locally. (40 parts of Lead Subacetate to 60 parts of Cotton Seed Oil.)

Plŭmbi Carbōnas—Plŭmbi Carbonātis—Lead Carbonate. *U. S. P.*

(WHITE LEAD.)

Origin.—Obtained by passing Carbon-dioxide Gas through a solution of Lead Acetate, or by adding an Alkali Carbonate to a solution of a Neutral Lead Salt.

Description and Properties.—A heavy, white, opaque powder or a pulverulent mass, without odor or taste. Permanent in the air. Insoluble in water or alcohol, but soluble in acetic or diluted acetic acid, with effervescence. Lead carbonate should be kept in well-stoppered bottles. Used externally and locally.

Official Preparation.

Unguĕntum Plŭmbi Carbonātis—Unguĕnti Plŭmbi Carbonātis—Ointment of Lead Carbonate (10 per cent.).—Used externally and locally.

Plŭmbi Iōdidum—Plŭmbi Iōdidi—Lead Iodide. *U. S. P.*

Origin.—Obtained by mixing a solution of Lead Nitrate and Potassium Iodide, and drying the precipitate.

Description and Properties.—A heavy, bright-yellow powder without odor or taste. Permanent in the air. Soluble in about 2000 parts of water and in about 200 parts of boiling water, separating from the latter solution in brilliant golden-yellow spangles or crystalline laminæ. Very slightly soluble in alcohol, but soluble, without color, in solutions of the fixed alkalies, in concen-

trated solutions of the acetates, of the alkalies, potassium iodide, and sodium hyposulphite, and in a hot solution of ammonium chloride. Lead iodide should be kept in well-stoppered bottles.

Dose.—$\frac{1}{8}$ grain (0.13 Gm.).

Official Preparation.

Unguĕntum Plŭmbi Iōdidi—Unguĕnti Plŭmbi Iōdidi—Ointment of Lead Iodide (10 per cent.).—Used externally and locally.

Plŭmbi Nītras—Plŭmbi Nitrātis—Lead Nitrate. *U. S. P.*

Origin.—Prepared by dissolving Lead in Diluted Nitric Acid.

Description and Properties.—Colorless, transparent, octahedral crystals, or white, nearly opaque crystals, without odor and having a sweetish, astringent, and afterward metallic taste. Permanent in the air. Soluble in 2 parts of water; almost insoluble in alcohol. Used externally and locally.

Plŭmbi Ŏxidum—Plŭmbi Ŏxidi—Lead Oxide. *U. S. P.*

(LITHARGE.)

Origin.—Obtained by roasting Lead in air.

Description and Properties.—A heavy, yellowish or reddish-yellow powder or minute scales, without odor or taste. On exposure to the air it slowly absorbs moisture and carbon dioxide. Almost insoluble in water and insoluble in alcohol. Soluble in acetic or diluted nitric acid and in warm solutions of the fixed alkalies. Lead oxide should be kept in well-closed vessels. Used externally and locally.

Official Preparations.

Emplăstrum Plŭmbī—Emplăstra Plŭmbi—Lead Plaster (DIACHYLON PLASTER).—Used externally and locally.

(Lead Oxide or Lead Plaster is contained in Emplastrum Ammoniaci cum Hydrargyro and in Emplastra Ferri, Hydrargyri, Opii, Resinæ, and Saponis.)

Unguĕntum Diăchylon—Unguĕnti Diăchylon—Diachylon Ointment.—(Lead Plaster, 500; Olive Oil, 490; Oil of Lavender Flowers, 10.) Used externally and locally.

Physiological Action.—Lead *per se* is practically inert; some of its salts, however, particularly the acetate, possess valuable therapeutic properties.

Externally and Locally.—Applied to the unbroken skin, lead salts have little if any effect, yet they act readily upon denuded surfaces, blanching the tissue of the parts by contraction of the small blood-vessels. In sores and ulcers they coagulate the albumin of the discharge and the protoplasm of the neighboring superficial cells, thus forming a protective coating for the healthier structure beneath.

These salts have likewise a sedative action because of the decreased local circulation and the presumably depressant effect upon the nerve endings. Moreover, by virtue of their astringency they furnish valuable hemostatic and antiphlogistic remedies. In some cases the skin is discolored by their use.

Internally.—Digestive System.—Lead acts immediately in the mouth, causing a sweet, styptic taste and coagulating the mucus. It contracts the cells and vessels of the entire alimentary canal, inducing dryness by diminished secretion. Consequent to the disturbed physiological functions of the digestive tract, the peristaltic movements diminish, and constipation necessarily ensues.

Circulatory System.—The heart's action is slowed through the branches of the vagus by irritation of the cardiac inhibitory center. The pulse is lessened in volume and frequency, and lacks regularity.

The blood takes up the lead as an albuminate, which soon passes into the tissues. While yet in the vascular system it interferes with the nutritive function of the corpuscles, producing by their destruction a watery condition of the blood. This explains the anemia usually present in cases of plumbism or lead-poisoning.

Nervous System.—Both sensory and motor functions become deranged, especially the latter. This central irritation causes a disturbance, and finally paralysis, of various muscles. The involuntary muscles appear to be most affected, and of these primarily the intestinal; hence, with the assistant local effect, arise distressing abdominal pains and spasms. The cardiac center and vagal branches to the heart are influenced, as already stated.

Respiratory System.—The irritation produced in the respiratory centre has an inhibitory action through the vagus upon the respiration.

Absorption and Elimination.—The preparations of lead are converted in the stomach into an albuminate, and thence taken up by the blood, very little absorption taking place in the intestine, where the lead is converted into an insoluble sulphide. It is absorbed by the abraded skin, and enters directly into combination with the

albumin of the tissues. A portion of the lead albuminate is eliminated by the liver with the bile into the intestine, where, being converted into a sulphide, it is excreted in that form with the feces. The skin, kidneys, and mammary glands assist in its elimination.

Lead is not easily removed from the whole system, owing to its retention by the ubiquitous albumin; consequently some alterative, such as potassium iodide, should be administered.

Uterus.—Under the influence of lead, abortion is liable to occur or the child be still-born. This is probably due to a disturbance of the quality and quantity of the blood-supply to the affected parts.

Untoward Action.—Undesirable results have followed the administration of medicinal doses of lead acetate, evidently arising from insufficient elimination. Baker observed loss of appetite, gastralgia, constipation, and paralysis of three weeks' duration. This last symptom occurred in the hand of a man who had taken 1 grain (.06 Gm.) of lead acetate twice daily for four days to relieve hematuria. In another case attacks of colic, lasting several months, followed the exhibition of 4 grains (.25 Gm.) of the same salt for three days. Tanquère des Planches suggests caution in too free an administration of lead preparations, as being prone to occasion disagreeable symptoms.

The external application of lead solutions and ointments sometimes produces unpleasant effects, such as discoloration of the skin. In the mucous membrane lead rarely excites symptoms of poisoning, a single case being reported where lead water compresses were applied to the eye. Gastric pains have occurred after repeated applications of such compresses to a contused shoulder, the pains ceasing with their withdrawal and reappearing with a renewal of the treatment. Colic and paralysis of the member have followed washing of a large ulcer of the leg with lead water, these symptoms disappearing upon a withdrawal of the drug. In still another case a sweetish, styptic taste in the mouth and stiffness of the neck resulted from the external use of the solution.

Poisoning.—Cases of acute poisoning are in therapeutics fortunately rare, the acetate—the form generally given—producing emesis, thus preventing toxic effects of the drug.

The first symptom of poisoning is a sweetish, metallic taste, soon followed by nausea and vomiting of a white, milky fluid containing curdy material—the result of a combination of the excessive lead with the hydrochloric acid of the gastric juice, and the

formation of lead chloride. Constipation and subsequent diarrhea usually occur, with black passages, the discoloration being caused by the sulphide of lead formed in the intestinal canal. There is severe, persistent pain in the abdominal muscles, which are rigid and contracted, while a retraction of the abdominal walls is clearly perceptible. There are great thirst, and possibly cramps in the calves of the legs, neuralgic pains, muscular twitchings, vertigo, stupor, anesthesia, and paralysis. Tenesmus is present, and the face is pale and the lips livid. As a rule, the liver is retracted and often diminished in size. The pulse is rapid and tense at first, becoming weak, compressible, and slow.

Treatment of Poisoning.—Evacuation of the stomach is imperative, the process being more or less assisted by the emetic property of the drug. Some sulphate should be administered in order to form an insoluble lead compound. Epsom and Glauber's salts are the best antidotes, since they are readily soluble and easily obtained; acting, moreover, as a purge, they empty the intestinal canal. Opium will serve to relieve pain and irritation, while to maintain bodily temperature hot applications can be used on the feet and abdomen.

Chronic Poisoning.—The acute form of poisoning just considered is always produced by a soluble lead salt; chronic plumbism, on the contrary, is generally caused by an insoluble salt. The symptoms are numerous and manifold, there being no physiological disturbance of the acute which is not present in the chronic condition. The train of untoward symptoms is occasioned by long-continued medicinal use of lead preparations. Very frequent sources of poisoning are: drinking water conveyed in lead pipes, and foods colored with chrome yellow and those contained in cans soldered with lead. It is especially liable to occur among painters (colica pictonum), manufacturers of lead salts, color-grinders, and type-setters and founders.

Wrist-drop, bilateral, resulting from paralysis of the extensor muscles of the forearm, is one of the most prominent symptoms, although not a constant occurrence. The supinator longus, being also a flexor, usually escapes this influence. Colic, sharp abdominal pains, chiefly in the umbilical region, retraction of the abdominal muscles and cramps, and paralysis of the calves of the legs may be present in plumbism—or "saturnism," as it is sometimes termed, a word transmitted to us from medieval alchemy. Obsti-

nate constipation, with the passage of clay-colored stools, as has been stated, necessarily occurs; and anorexia, gastralgia, and arthralgia are seldom absent. The liver, the most important medium in the elimination of the poison, in severe cases becomes overtaxed and reduced in size. The tongue is white and coated, and the skin, lips, and mucous membranes are discolored. A blue line on the anterior gums is pathognomonic, although it may be absent in those who take special care of the teeth.

Headache, delirium, and epileptiform convulsions, constituting encephalopathia saturnina, may occur, being usually due to uremia induced by insufficient elimination of the poison. Albuminuria, anemia, cirrhosis, and contraction of the kidneys, with diminished excretion of uric acid, are present, and amblyopia and amaurosis may be included among the symptoms. The heart and the entire vascular system are, as has been said, considerably deranged. Multiple neuritis, anterior poliomyelitis, and atrophy of the nerve-trunks, with resultant muscular wasting and loss of power, gradually manifest themselves. Gout sometimes occurs, and, as noted in acute poisoning, miscarriage is liable to take place.

Treatment of Poisoning.—The sulphates are given for their chemical and purgative effects, yet in chronic plumbism the hepatic purgatives—calomel, gamboge, jalap, etc.—are preferable. Opium and morphine relieve pain and spasms, being claimed by some authorities as specifics in lead-poisoning. Sulphuric-acid lemonade and plenty of milk have been found beneficial. Potassium iodide in ten-grain doses, three times daily, has an eliminative effect. The cerebral symptoms may be alleviated by a diaphoretic, such as pilocarpin or an alcohol sweat.

In progressive paralysis strychnine is widely employed. Faradization of the muscles, if they respond, or otherwise galvanization, should be used to increase muscular force and prevent atrophy.

PLUMBI ACETATIS.—This being the typical lead salt, its action will be first considered.

Therapeutics.—*Externally and Locally.*—It acts as a sedative as well as an astringent in *acute inflammations*, such as *eczema* (not chronic), *impetigo*, *lichen*, and *erythema;* but it must not be used stronger than 10 grains (0.64 Gm.) to 1 ounce (30.0 Cc.) of water.

It is of service as an injection in *gonorrhea*, *leucorrhea*, *gleet*, and *otorrhea*. In combination with opium it makes a good topical application for *hemorrhoids*. As a gargle it is of some value, and is also serviceable in *orchitis*, *synovitis*, and *paronychia*.

Internally.—Its most important use is in *checking hemorrhages*, in which it is associated with opium, although it is chemically incompatible with that drug. It is of service in *hemorrhage* in *typhoid fever*, *yellow fever*, *hemoptysis*, and *gastric ulcer*. It lowers the heart's action, constringing the arterioles, in this respect resembling digitalis, combined with which drug it is beneficial in *hypertrophy of the heart*.

Morbid discharges, such as the *night-sweats* and *diarrhea of phthisis* and the *diarrhea of typhoid*, *dysentery*, *cholera infantum*, *secretions in bronchorrhea*, and *serous diarrhea*, are effectually checked by the acetate of lead and opium, which diminishes the pain, griping, and tenesmus attending the respective affections. By far its most frequent use, however, is in *serous diarrheas*, the drug acting very quickly and efficiently, and being both sedative and astringent.

Given in *chronic gastritis with pain*, lead acetate affords marked relief. It was at one time advocated in *internal aneurysm*, but is of little if any value in this respect.

LIQUOR PLUMBI SUBACETATIS.—This preparation is used extensively for *bruises*, *sprains*, *acute eczema*, and as a cooling application in *ecthyma*, *erysipelas*, and all kinds of *inflammations;* it should be well diluted. It also relieves the *itching of urticaria*, *pruritus pudendi*, and *eczema*.

A *felon* may be aborted by saturating bread-crumbs with Goulard's solution, making a poultice, and placing it over the finger.

PLUMBI IODIDI.—Used very little. It acts beneficially when employed as an ointment applied to *enlarged lymphatic glands and spleen;* also for *psoriasis* and *chronic eczema*.

It is given in 1–2 grain- (0.06–0.12 Gm.) doses to reduce malarial spleen.

CARBONATE OF LEAD is used only externally, in the form of an ointment, for *burns*, *scalds*, *erysipelas*, and *intertrigo*. It should never be applied to *abraded surfaces*, as it is rapidly absorbed. It should be mixed with linseed oil.

PLUMBI OXIDUM.—Hebryre commends an application of equal parts of lead plaster and linseed oil for *sweating of the feet*. It is chiefly used in the preparation of diachylon or lead-plaster, emplastrum saponis and emplastrum resinæ being also prepared with the oxide.

PLUMBI NITRAS.—Used with good results in *onychia* and also in the manufacture of Ledoyne's disinfectant. It is an excellent remedy for *fissured nipples*, care being taken to wash the nipple

before suckling. Should the fissures be deep, it is well to wash the nipple with morphine sulphate or a little cocaine, as the lead application is exceedingly painful.

It destroys the *fetid odor* arising from *gangrenous sores* and *offensive discharges* from the *ears*, *nostrils*, *rectum*, and *vagina*. It has also proved serviceable in *epithelioma*.

CHLORIDE OF LEAD and TANNATE OF LEAD have been used externally as ointments—the chloride to allay *pain* and *arrest morbid growths*, and the tannate in threatening *bed-sores*.

Administration.—Locally a watery solution of lead acetate, 10 grains (0.64 Gm.) to 1 ounce (30.0 Cc.), is used. Powdered opium can be added, 1 drachm to the pint of water. Applied to mucous membranes or used as an injection, 2 grains (0.12 Gm.) to 1 ounce (30.0 Cc.) of water, or 5 grains (0.32 Gm.) of the acetate and 5 (0.32 Gm.) of zinc sulphate in 1 ounce (30.0 Cc.) of water—rose-water, for instance—proves a most efficient application. Suppositories for hemorrhoids may contain 1 grain (0.06 Gm.) of opium to 3–5 grains (0.19–0.32 Gm.) of the acetate. The pilulæ plumbi cum opio—lead acetate 3 grains (0.19 Gm.), opium 1 grain (0.06 Gm.)—is mostly used internally, one pill being taken every three hours. In dysentery and cholera infantum an enema containing 5 grains (0.32 Gm.) of lead acetate to 1 grain (0.06 Gm.) of opium, or ½ grain (0.03 Gm.) of morphine to 1 ounce (30.0 Cc.) of water, gives excellent results.

Should there be any abrasion of the skin, lead subacetate must not be used, as it prevents healing by constringing the edges of the wound.

It is not used internally.

Solution of subacetate of lead is most frequently used in union with opium, forming the well-known L. and L., or lead-water-and-laudanum, solution. It is also used in conjunction with glycerin, 1 ounce of each, or as Goulard's cerate, consisting of 20 parts Goulard's extract to 80 parts camphor cerate.

For ulcers, fissured nipples, and epithelioma lead nitrate is used, chiefly in the powdered form. In the nose, ears, vagina, and rectum a douche (2–5 grains (0.13–0.32 Gm.) to 1 ounce (30.0 Cc.) of water) is used. A solution of 10 grains (0.64 Gm.) to 1 ounce (30.0 Cc.) of glycerin or brandy is a very good application for sore nipples.

Zĭncum—Zĭnci—Zinc. *U. S. P.*

Origin.—Obtained by roasting the native Zinc Sulphide or Carbonate, and reducing the resulting oxide with charcoal.

Description and Properties.—A bluish-white metal, showing a crystalline fracture and having a specific gravity ranging from 6.9 when it is cast to 7.2 after it is rolled. Soluble in diluted sulphuric or hydrochloric acid, with evolution of hydrogen gas.

Metallic zinc occurs in the form of thin sheets or in irregular, granulated pieces, or moulded into thin pencils, or in a state of fine powder.

The following salts of zinc are official:

Zĭnci Acētas—Zĭnci Acetātis—Zinc Acetate.—*Origin.*—Obtained by dissolving Zinc Acetate in Acetic Acid and Water and boiling: zinc acetate crystallizes out.

Description and Properties.—Soft, white, six-sided, monoclinic plates, of a pearly luster, having a faintly acetous odor and an astringent metallic taste. Exposed to the air, the salt gradually effloresces and loses some of its acid. Soluble in 2.7 parts of water and 36 parts of alcohol. Zinc acetate should be kept in well-stoppered bottles.

Dose.—As a tonic, ½–2 grains (0.03–0.12 Gm.); as an emetic, 10–30 grains (0.6–2.0 Gm.); but principally used externally and locally.

Zĭnci Carbōnas Præcipitātus—Zĭnci Carbonātis Præcipitāti—Precipitated Zinc Carbonate.—*Origin.*—Prepared by pouring together solutions of Zinc Sulphate and Sodium Carbonate, and drying the precipitated zinc salt.

Description and Properties.—An impalpable white powder, of somewhat variable chemical composition, without odor or taste; permanent in the air. Insoluble in water or alcohol.

Dose.—2–3 grains (0.12–0.18 Gm.). Chiefly used externally.

Zĭnci Iōdidum—Zĭnci Iōdidi—Zinc Iodide.—*Origin.*—Prepared by dissolving Zinc Oxide or Carbonate in Hydriodic Acid.

Description and Properties.—A white, granular powder, odorless, having a sharp, saline, and metallic taste. Very deliquescent, and liable to absorb oxygen from the air, becoming brown from liberated iodine. Readily soluble in water, alcohol, or ether. Zinc iodide should be kept in small glass-stoppered bottles.

Dose.—½–2 grains (0.03–0.12 Gm.). Also used externally.

Zĭnci Sŭlphas—Zĭnci Sulphātis—Zinc Sulphate.—*Origin.*—Prepared by dissolving Granulated Zinc in Sulphuric Acid, certain precautions being taken to remove impurities.

Description and Properties.—Colorless, transparent, rhombic crystals, without odor, and having an astringent, metallic taste. Efflorescent in dry air. Soluble in 0.6 part of water and in 3 parts of glycerin; insoluble in alcohol. Zinc sulphate should be kept in well-stoppered bottles.

Dose.—1–3 grains (0.06–0.18 Gm.); as an emetic, 10–60 grains (0.6–4.0 Gm.).

Zĭnci Ŏxidum—Zĭnci Ŏxidi—Zinc Oxide.—*Origin.*—Prepared by heating Zinc Carbonate to redness in a crucible.

Description and Properties.—An amorphous white powder without odor or taste. Insoluble in water or alcohol. It should be kept in well-stoppered bottles.

Dose.—¼–5 grains (0.015–0.3 Gm.).

Official Preparations of Zinc Oxide.

Unguĕntum Zĭnci Oxidi—Unguĕnti Zĭnci Oxidi—Ointment of Zinc Oxide (20 per cent.).—Used externally and locally.

Antagonists and Incompatibles.—The salts of zinc are incom-

patible with the vegetable astringents, alkalies and their carbonates, lime water, the sulphides, silver nitrate, lead acetate, and milk.

Synergists.—The same as for lead.

The metallic form is not used in medicine.

Physiological Action.—*Externally and Locally.*—The zinc salts resemble the lead salts in their action, but they are less powerful astringents. They are also to a slight extent hemostatic. The chloride is exceedingly caustic.

Internally.—Digestive System.—The sulphate of zinc and, in a slight degree, the carbonate are specific emetics, causing rapid emesis, with but little nausea or depression. Their *modus operandi* is not definitely known, but it is believed that their effects are partly due to local action on the stomach, and partly to stimulation of the vomiting center in the medulla.

Vomiting is also produced by injecting a solution of the salt into the circulation; but this is doubtless owing to the fact that the salt is excreted by the stomach, and that it also exerts an influence on the medullary center.

The salts of zinc also act as astringents upon the gastro-intestinal mucous membrane.

Circulatory System.—Practically nothing is known of the action of zinc salts on the heart, blood, and vessels. They exist in the blood as albuminates, in close relation with the red corpuscles.

Nervous System.—Zinc valerianate acts as a sedative, but this action is wholly dependent upon the valerian.

The salts are also astringents and possess some tonic properties. They may cause transverse myelitis.

Absorption and Elimination.—The zinc salts are absorbed from the stomach or enter directly into the circulation when injected. They are eliminated by the liver and kidneys, but mainly by the intestinal glands. Zinc salts do not accumulate so rapidly as mercury, lead, and copper.

Untoward Action.—3–5 grains (0.19–0.32 Gm.) have produced nausea and gastric oppression, while if the zinc salt reaches the intestines diarrhea results. When taken on a full stomach the salts form an insoluble albuminate which undergoes the regular digestive process.

Repeated small doses, 3 grains (0.19 Gm.), have produced gastric oppression, eructations, slight confusion of thought, dizziness, bodily exhaustion, thirst, gastralgia, vomiting, and diarrhea. Zinc dyscrasia may follow, characterized by obstinate constipation, emaciation, and anemia.

Poisoning.—Continued use or excessive doses of zinc will produce poisoning, with symptoms resembling those of lead-poisoning. Chronic zinc-poisoning is rare.

Treatment of Poisoning.—Chemical antidotes are the bicarbonates of soda and potassium. Flour and water, soapsuds, and milk are also beneficial. Morphine given hypodermically relieves the vomiting. Laxatives and potassium iodide may serve later to assist in eliminating the zinc.

Therapeutics.—ZINC OXIDE.—*Externally and Locally.*—The ointment or powder is used in *chronic eczema, intertrigo, burns, fissured nipples, anal fissure, ulcers,* and *skin diseases.* In combination with linseed oil the oxide has also been used in *erysipelas.* The drug has proved useful as an injection in *leucorrhea.*

Internally.—Associated with bismuth, sodium bicarbonate, or belladonna, it is very effective in *diarrhea*—particularly the *summer diarrhea of children*—and *dysentery.*

It is a most excellent remedy for *colliquative sweating* and the *sweating of phthisis,* and also serves to check the profuse secretion of *bronchorrhea,* although its use may occasion disordered digestion, since zinc is but sparingly soluble.

It has been used extensively in the treatment of *hysteria, spasmodic asthma, chorea,* and *epilepsy;* yet, even though it is claimed to be a specific, its action as such is exceedingly doubtful.

Zinc oxide has proved highly beneficial in *whooping cough, delirium tremens,* and *chronic alcoholism*—especially the two latter, which are attended with considerable nervousness.

The oxide is also valuable in *gastralgia.*

ZINC ACETATE.—It is used only externally and as an injection in *gonorrhea* and *leucorrhea.* In *conjunctivitis* it is useful as a collyrium.

ZINC SULPHATE.—*Externally and Locally.*—The external use is chiefly in *weeping eczema, pruritus,* and *ulcers.* Locally it is of service as a wash in *ophthalmia* and *conjunctivitis,* and as an injection in *gonorrhea, leucorrhea, vulvitis,* and *otitis.* It is also used in *gangrenous stomatitis, cancrum oris,* and as a gargle in *enlarged tonsils* and *relaxed sore throat.* In *nasal polypi* the powder is insufflated, the solution being applied to the stump after removal of the polypus. It dries up soft *tumors* near the vagina, anus, and female urethra. It is also used in *lupus exedens* and *cancer of the breast,* but does not act upon parts covered by epithelium. Its application is very painful, but the eschar does not tend to spread, and separates much more readily than those of many other caustics.

Internally.—Its chief use is that of an emetic after ingestion of poison, irritating foods, and especially narcotics, as well as where the air-passages are obstructed, as in *croup* and *diphtheria*.

It acts as an astringent in *chronic diarrhea* and *dysentery* when associated with opium and ipecac. It is serviceable in *typhoid fever*, *flatulent dyspepsia*, *coursing oxularia*, *spasmodic asthma*, and *whooping cough*. Like the other zinc salts, it has also been used in *hysteria*, *chorea*, *epilepsy*, and *angina pectoris*.

ZINC CARBONATE.—This preparation is used only externally, for *blisters*, *weeping eczema*, and *intertrigo*. It is employed in the form of a powder, but generally as an ointment—CARDAMINE OINTMENT.

ZINC IODIDE.—This salt is but little used, but is of some value as a *gonorrheal* injection, as an application to *enlarged* and *indurated tonsils*, and in *scrofulous glands*.

ZINC PHOSPHIDE and ZINC VALERIANATE are used only for the benefit derived from the phosphorus and valerianic acid, and may properly be omitted here.

Administration.—Externally the powder or ointment of zinc oxide is used, or the drug may be mixed with powdered starch, lycopodium, or acacia. Before applying these preparations it is well to wash the parts with a weak solution of carbolic acid.

Internally, $\frac{1}{4}$ grain (0.01 Gm.) zinc oxide and 3 grains (0.19 Gm.) sodium bicarbonate are given in diarrhea, or, if preferable, bismuth subnitrate 10 grains (0.64 Gm.), pepsin (Sheffer's) 3 grains (0.19 Gm.), and zinc oxide $\frac{1}{2}$–1 grain (0.03–0.06 Gm.), with a little opium added.

As an injection a combination of 10 grains (0.64 Gm.) each of zinc sulphate and lead acetate is used, the two salts interacting and producing lead sulphate—which is precipitated and insoluble—and zinc acetate.

Locally and externally the dry powder of zinc sulphate is used, or a mixture of zinc sulphate 10 grains (0.64 Gm.), aqua rosæ 4 ounces (118.29 Cc.), and glycerin 1 drachm (4.0 Cc.), as a lotion. As an injection it is associated with lead acetate, forming the zinc acetate and lead sulphate. In *ophthalmia neonatorum* zinc sulphate 5 grains (0.32 Gm.), morphine sulphate 3 grains (0.19 Gm.), and aqua rosæ 1 ounce (30 Cc.), perhaps with atropine added, form an excellent mixture.

Internally, in dyspepsia 1–2 grains (0.06–0.12 Gm.) may be given, and for intestinal affections 1 grain (0.06 Gm.) each of the sulphate, owdered opium, and ipecac three times daily. To produce emesis grains (0.32 Gm.) are sufficient.

The collyrium consists of ½ grain (0.03 Gm.) of the salt in 1 ounce (30 Cc.) of rose water.

Cūpri Sŭlphas—Cūpri Sulphātis—Copper Sulphate. *U. S. P.*

Origin.—Prepared by heating Copper and Sulphuric Acid together, dissolving the soluble product in hot Water, and evaporating.

Description and Properties.—Large, transparent, deep blue triclinic crystals, odorless, of a nauseous, metallic taste; slowly efflorescent in dry air. Soluble in about 2.6 parts of water and in 0.5 part of boiling water; almost insoluble in alcohol.

Dose.—⅛–½ grain (0.008–0.03 Gm.), as an astringent; as an emetic, 2–20 grains (0.12–1.2 Gm.).

Antagonists and Incompatibles.—Alkalies and their carbonates, the sulphides, mineral salts (except the sulphates), lime water, the iodides, and vegetable astringents.

Synergists.—The same as for lead.

Physiological Action.—Copper sulphate is the salt mostly used, and the only official preparation. Its action is therefore given as characteristic of that of cuprum.

Externally.—Applied to the unbroken skin, it produces little effect, but on raw surfaces or mucous membranes it acts as a painful caustic and astringent. It also possesses antiseptic properties.

Internally.—Digestive System.—It acts as an irritant, causing vomiting of greenish matter, though nausea does not follow the emesis. The secretions are augmented, and salivation and purging of blood and mucus are attendant consequences of its ingestion. Should emesis be delayed, the stomach should immediately be emptied, otherwise the copper is liable to produce inflammation.

Circulatory System.—Copper exists normally in the blood, and acts as a tonic, being present in the circulation as an albuminate. It depresses the heart's action, causing a small, weak, rapid pulse.

Nervous System.—It acts as a depressant.

Respiratory System.—Its influence is to hasten and depress the respiratory movements.

Absorption and Elimination.—Copper salts are slowly absorbed, tending to accumulate in the liver. The drug is eliminated by the liver, kidneys, salivary glands, and intestinal canal.

Poisoning.—Acute poisoning results from the inhalation of cupreous fumes, eating fruits cooked in copper vessels, or from an overdose of a copper salt.

When inhaled the first symptoms are those of bronchial catarrh and irritation. Internally administered, the symptoms do not usually appear at once, but after an hour's interval there are manifest a strong metallic taste in the mouth, burning and constriction of the pharynx and fauces, salivation and vomiting of greenish matter, and purging, the passages after a while containing mucus streaked with blood. There are present also burning in the epigastrium and griping, colicky pains.

Copper enters the circulation quickly, it being highly diffusible. A characteristic symptom of poisoning is a green line on the gums. Sometimes jaundice may be present, and headache, convulsions, suppression of urine, cardiac depression, and hurried respiration are among the graver symptoms.

Treatment of Poisoning.—A chemical antidote should be given at once, potassium ferrocyanide being the best, as it forms an insoluble copper cyanide. Other recourses are white of egg, milk, sweet oil, emetics, and the use of the stomach-pump. A mustard plaster, with a little opium added to allay the pain and irritation, may be applied over the pit of the stomach as a counter-irritant. Should vomiting have already occurred, emetics should be withheld.

Chronic poisoning usually results from long-continued use of the medicine. The symptoms are the same as those of acute poisoning, with the following superadded: paresis of the limbs, paralysis, incoördination of muscles, atrophy of the liver, with fatty degeneration of the liver-cells, and proliferous growth of the connective tissue. There may also be present congestion of the lungs and fatty degeneration of the kidney, together with bronchial catarrh. The treatment is the same as for acute poisoning.

Therapeutics.—*Externally and Locally.*—COPPER SULPHATE stimulates *old, flabby, granulating ulcers. Ring-worm, scabies,* and *tinea sycosis* derive great benefit from its use.

The crystal or solution, 2 grains to 1 ounce (0.12–32.0 Gm.) of water, is used extensively in *conjunctivitis, tinea tarsi,* and *trachoma condylomata,* and as a gargle in relaxed *sore throat.* The aphthæ in *aphthous stomatitis* are benefited by touching with the copper-sulphate solution. It is also used as an injection in *gonorrhea* and *gleet,* 2 grains to 1 ounce (0.12–32.0 Gm.). It is also valuable in *mercurial sore mouth* and *gangrene of the pharynx.*

Internally.—COPPER SULPHATE is the chemical antidote for phosphorus-poisoning, yet it should be given with great caution,

lest of itself it produce acute poisoning. It is a speedy emetic, since it acts directly upon the stomach. If emesis is not produced by the first dose, sulphate of zinc or mustard may be employed. It is used as an emetic in *croup*.

In *chorea*, *hysteria*, and *epilepsy* copper is beneficial. In *chronic dysentery* and *diarrhea* an enema of a pint of water (512.0 Gm.) and 10 grains (0.6 Gm.) of sulphate of copper is an efficient remedy, being by some authors considered the best metallic astringent in *chronic dysentery*.

Copper associated with arsenic is highly beneficial in *anemia*, building up the blood and adding firmness to the flesh.

OLEATE OF COPPER is used in the skin affections mentioned.

NITRATE and ACETATE OF COPPER act like the sulphate.

ARSENITE OF COPPER has been suggested as a remedy in *anemia*, and has been used in doses of $\frac{1}{100}$ grain (0.0006 Gm.) in *diarrhea* and *cholera infantum*.

Administration.—For an enema in diarrhea and dysentery it may be combined with opium—2 grains to 1 ounce (0.12–32.0 Gm.) of water being used. For eye affections the crystal or solution is employed. In addition to the enema copper sulphate, 1 grain (0.06 Gm.) may be united with magnesium sulphate 1 ounce (32.0 Gm.) and 1 drachm (4.0 Gm.) diluted sulphuric acid in 4 ounces (128.0 Gm.) of water, a tablespoonful of the mixture being given every three or four hours. To produce emesis 10–15 grains (0.6–1 Gm.) are dissolved in about 5 ounces (160.0 Gm.) of water, a tablespoonful being given every ten minutes until vomiting is produced.

Argĕnti Cyănidum—Argĕnti Cyănidi—Silver Cyanide. *U. S. P.*

Origin.—Obtained by distilling a solution of Potassium Ferrocyanide acidulated with Sulphuric Acid, the distillate passing into a receiver containing a solution of Silver Nitrate. The process should be continued until the distillate no longer produces a precipitate in the receiver. The precipitate is finally washed with distilled water and dried.

Description and Properties.—A white powder, without odor or taste; permanent in dry air, but gradually turning brown on exposure to light. Insoluble in water, alcohol, or cold nitric acid; soluble in boiling nitric acid, ammonia water, and solution of

sodium hyposulphite or potassium cyanide. It should be kept in dark, amber-colored vials, protected from light. Not used internally.

Official Preparation.

Ăcidum Hydrocyănicum Dilūtum—Ăcidi Hydrocyănici Dilūti—Diluted Hydrocyanic Acid (PRUSSIC ACID).—*Dose*, 2–5 minims (0.12–0.3 Gm.). (Described under Hydrocyanic Acid, page 519.)

Argĕnti Iōdidum—Argĕnti Iōdidi—Silver Iodide. *U. S. P.*

Origin.—Prepared from Silver Nitrate and Potassium Iodide, washing and drying the precipitate.

Description and Properties.—A heavy, amorphous, light-yellowish powder, unaltered by light if pure, but generally becoming somewhat greenish-yellow; without odor or taste. Insoluble in water and alcohol. Silver iodide should be kept in dark, amber-colored vials, protected from light.

Dose.—$\frac{1}{4}$–1 grain (0.015–0.06 Gm.).

Argĕnti Nītras—Argĕnti Nitrātis—Silver Nitrate. *U. S. P.*

Origin.—Obtained by dissolving Silver in Nitric Acid with the aid of heat, evaporating, and crystallizing.

Description and Properties.—Colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in presence of organic matter. Without odor, but having a bitter, caustic, and strongly metallic taste. Soluble in 0.6 part of water and in 26 parts of alcohol. It should be kept in dark, amber-colored vials, protected from light.

Dose.—$\frac{1}{4}$–1 grain (0.015–0.06 Gm.).

Official Preparations.

Argĕnti Nītras Dilūtus—Argĕnti Nitrātis Dilūti—Diluted Silver Nitrate (MITIGATED CAUSTIC).—*Origin.*—Prepared by fusing together Silver Nitrate 30, and Potassium Nitrate 60, and casting in suitable moulds.

Description and Properties.—A white, hard solid, generally in the form of pencils or cones of a finely granular fracture, becoming gray or grayish-black on exposure to light in the presence of organic matter; odorless, having a caustic, metallic taste, neutral to litmus-paper. It should be kept in dark, amber-colored vials. Used externally.

Argĕnti Nītras Fūsus—Argĕnti Nitrātis Fūsi—Moulded Silver Nitrate (LUNAR CAUSTIC).—*Origin.*—Obtained by melting Silver Nitrate 100, Hydrochloric Acid 4, and pouring the melted mass into suitable moulds.

Description and Properties.—A white, hard solid, usually cone- or pencil-shaped, of

a fibrous fracture, becoming gray or grayish-black on exposure to light in presence of organic matter; odorless, having a bitter, caustic, and strongly metallic taste. Soluble in 0.6 part of water and in 26 parts of alcohol. The product should be kept in dark, amber-colored vials, protected from light. Used externally and locally.

Argĕnti Ŏxidum—Argĕnti Ŏxidi—Silver Oxide. *U. S. P.*

Origin.—Prepared by shaking a solution of Silver Nitrate with solution of Potassa and washing the precipitate.

Description and Properties.—A heavy, dark, brownish-black powder, liable to reduction by exposure to light; odorless, with a metallic taste; very slightly soluble in water and insoluble in alcohol.

Dose.—½–2 grains (0.03–0.12 Gm.).

Antagonists and Incompatibles.—The silver nitrate is incompatible with the alkalies and their carbonates, chlorides, hydrochloric and tannic acids, potassium iodide, solutions of arsenic, and many of the organic acids.

Silver oxide is rapidly oxidized, forming explosive compounds with chlorides and organic substances.

Synergists.—Preparations of copper, lead, and zinc aid the action of silver salts.

The silver nitrate and its preparations and the silver oxide are the only salts which possess any value as astringents or caustics. The silver nitrate is the typical astringent salt, and its physiological action will be hereafter considered.

Physiological Action.—Metallic silver is practically of no use in medicine, though of great value in surgery, because of its inertness. Silver nitrate is the salt of silver chiefly employed.

Externally and Locally.—It is a powerful caustic, but does not wound very deeply, as it forms an eschar by coagulating the albumin of the tissue, thus protecting the underlying structures. The eschar is white, but on exposure to light very soon becomes black, owing to the fact that the silver is reduced to its metallic state.

Like lead salts, silver salts are hemostatic. They are severely irritant to mucous membranes when used in solution.

Internally.—Digestive System.—The drug causes increased secretion of intestinal glands and larger flow of bile. Silver salts are changed in the stomach into peptonates and albuminates. Under

ordinary doses nutrition is promoted; by large doses it is impaired, with resulting loss of flesh and weight.

Circulatory System.—The heart is stimulated by small doses, and the blood becomes darker and contains less fibrin. The red corpuscles lose shape and color and the hemoglobin is converted into hematin. Large doses depress cardiac action, while thrombosis and embolism may ensue.

Nervous System.—In small doses silver salts are tonic; in large doses they produce epileptiform convulsions and paralysis of centric origin.

Respiratory System.—The primary effect of the drug is to stimulate respiration. Large doses, however, cause death by paralysis of the respiratory center.

Absorption and Elimination.—It is absorbed from the stomach and eliminated very slowly, chiefly by the feces, a small portion being excreted by the kidneys.

Temperature.—At first increased; afterward, through the blood-changes, lowered.

Untoward Action.—Long-continued use of silver nitrate produces discoloration of the skin (argyria) either general or more pronounced in particular spots, such as the face. Even when the skin is perfectly intact the application of nitrate of silver will discolor it, $\frac{1}{4}$ grain (.016 Gm.) having caused palpitation of the heart and irregular pulse. Silver accumulates in the tissues.

Poisoning.—A poisonous dose of silver nitrate produces a violent gastro-enteritis. The earliest symptom is an intense pain in the abdomen, followed by vomiting and purging. The abdominal muscles are hard and retracted, the face livid and covered with perspiration and wearing an anxious expression. The lips are blanched, gradually becoming black; the vomited matter is blackish and sometimes resembles milk-curds.

Epileptiform convulsions, delirium, and paralysis ensue, the latter symptom being of centric origin.

Death results from cessation of respiration, due to the centric paralysis. A large amount of mucus is thrown into the bronchial tubes by the lining mucosa.

Treatment of Poisoning.—The chemical antidote is common salt. It is essential to protect the mucous membrane of the esophagus and stomach, and at the same time dilute the poison as much as possible, for which purposes large quantities of salt water and soap ater or milk are valuable. Opium allays the pain and irritation.

Chronic poisoning, or argyria, results from prolonged medicinal use of silver nitrate or its employment as a hair-dye for any length of time. The drug is deposited in all parts of the body, being especially manifest in a slaty, permanent discoloration of the skin. The first symptoms are discoloration of the sclerotic conjunctivæ and a dark line on the inner side of the lips. Ulcerative stomatitis may occur, or even gastric ulcer.

Treatment of Chronic Poisoning.—Iodide of potassium or hyposulphite of soda will aid in eliminating the poison. Baths of the hyposulphites or lotions of cyanide of potassium may produce absorption and excretion of the silver deposits, but the discoloration is rarely removed in any way.

Therapeutics.—*Externally and Locally.*—A very important use of SILVER NITRATE is that of preventing *ophthalmia neonatorum*, a 2 per cent. solution being dropped into the eyes. For adults a 2 to 4 per cent. solution is used in various forms of *conjunctivitis*, the eyelids being painted with a camel's-hair brush, and the solution being washed off immediately to prevent discoloration. The nitrate-of-silver stick may also be used.

Felons, *boils*, and *bed-sores* may be aborted by the use of a strong solution—20 grains to 1 ounce—of SILVER NITRATE.

An injection of 2–3 grains (.12–.20 Gm.) is beneficial in *subacute gonorrhea* and *leucorrhea*. This may also be used as a wash in *pruritus ani* and *vulvæ*, to relieve the itching. The stick may be applied to uterine *ulcers*.

As a caustic it is used in *indolent ulcers* and *chancroids*, stimulating them and producing a healthy granulating surface.

A solution painted over the eruption of variola is supposed to *prevent pitting*. The vesicles may also be punctured with a needle and the silver nitrate then introduced.

The pain and swelling of *orchitis* and *epididymitis* are considerably relieved by painting the scrotum with a solution of this salt.

After a cold, when the throat feels raw and sore, an application of 60 grains (4.0 Gm.) to the ounce (30.0 Cc.) is very beneficial, and the same may be used in *inflammations of the pharynx, fauces*, and *mouth*. A spray of 40 grains (2.59 Gm.) to the ounce (30.0 Cc.) is very effective in *laryngeal croup*, *trachitis*, *chronic ulceration of the larynx*, and *whooping-cough*. The caustic pencil is used in *tonsillitis*, *sore nipples*, *mercurial sore mouth*, and *poisoned*, *lacerated*, and *punctured wounds*. A solution of 1–2 grains (.06–.12 Cc.) to the

ounce (30.0 Cc.) is valuable in *otorrhea*, *vesical catarrh*, and *balanitis*.

Internally.—Dr. Pepper recommends this salt in *intestinal ulcerations*, given in keratin-coated pills. It is a cure for *gastric ulcer*, in which it may be combined with opium. *Gastralgia* and *chronic gastritis*, *ulceration of the rectum*, *dysentery*, and *diarrhea of typhoid* have been remarkably benefited by its use. For stomach affections $\frac{1}{8}$–$\frac{1}{4}$ grain (.01–.016 Gm.) is given, and for intestinal an enema of 3–10 grains (.20–.64 Gm.) to the ounce (30.0 Cc.).

It has been used in congested conditions of the cord, *locomotor ataxia*, *epilepsy*, and *chorea*. It is the only remedy of any value in locomotor ataxia; but, owing to the discoloration it produces, it cannot be used continuously, and in many cases it fails entirely.

ARGENTIC IODIDE was once used extensively in the treatment of *syphilis*, but is now obsolete.

ARGENTIC OXIDE is not so active as the nitrate. It has been employed for checking *sweats*, and, owing to its less caustic action, it may be preferable to the nitrate in *gastric ulcer* and *gastralgia*.

Administration.—The dose of silver nitrate is $\frac{1}{8}$–$\frac{1}{4}$ grain (.01–.016 Gm.), and for a constitutional effect should always be given in pill form during the process of digestion.

The keratin-coated pill is to be administered for intestinal disorders, and when a local action on the alimentary canal is desired an ordinary pill should be given one to two hours before meals.

It is well to discontinue the drug for a short time after three or four weeks' treatment, the salt being so slowly eliminated that its prolonged use is very apt to result in argyria.

Argonin.—*Origin*.—A soluble compound of Silver and Casein, first prepared by Röhmann and Liebreich.

Description and Properties.—A dilute solution of this substance in water is opalescent; opaque when concentrated, but immediately cleared by the addition of ammonia or carbonate of soda. Used externally and locally.

Physiological Action and Therapeutics.—Argonin is a very powerful, non-irritating germicide. The addition of a little ammonia to a solution of argonin vastly increases its bactericidal power, but deprives the drug of its bland, non-irritating character. It appears to lack astringent properties, and concentrated solutions are neither corrosive nor irritant.

From experimental research Meyer concludes that argonin has a strong disinfecting influence upon certain bacteria, particularly the gonococcus, investigation having shown that a 1:30,000 solution of ammoniacal argonin completely suspended the growth of this microbe for five minutes.

Judassohn, who has had an extensive experience with argonin in the treatment of *gonorrhea*, draws the following conclusions: (1) 1.5 to 2 per cent. solutions exert a rapidly destructive action upon gonococci. (2) Strong solutions are devoid of inflammatory

or corrosive action, and are consequently adapted to the treatment of acute gonorrhea of the anterior and posterior urethra in men, and of the uterus and urethra in women. (3) It appears to lack astringent properties, so that purely anticatarrhal treatment will indicate the assistance of other remedies.

Alūmen—Alūminis—Alum. *U. S. P.*

Origin.—Prepared by a complicated process from a mixture of Aluminum Silicate and Iron Sulphide by roasting, lixiviating with water, concentrating the solution, and, while hot, mixing with Potassium Chloride. Upon cooling the alum separates as a crystalline powder, which is purified by one or two recrystallizations.

Description and Properties.—Large, colorless, octahedral crystals, sometimes modified by cubes, or crystalline fragments, without odor, but having a sweetish and strongly astringent taste. On exposure to the air the crystals are liable to absorb ammonia and acquire a whitish coating. Soluble in 9 parts of water and 0.3 part of boiling water; also freely soluble in warm glycerin. Insoluble in alcohol.

Dose.—5–40 grains (0.3–2.60 Gm.); as an emetic, 1–2 drachms (4.0–8.0 Gm.).

Official Preparation.

Alūmen Exsiccātum—Alūminis Exsiccāti—Dried Alum (BURNT ALUM).—*Origin.*—Alum heated until it is deprived of its water of crystallization.

Description and Properties.—A white, granular powder, without odor, possessing a sweetish, astringent taste and attracting moisture from the air. Very slowly but completely soluble in 20 parts of water, and quickly soluble in 0.7 part of boiling water.

Dose.—1–5 grains (0.06–0.3 Gm.).

Unofficial Preparation.

Alūminis Glycerītum—Alūminis Glycerīti—Glycerite of Alum (20 per cent. alum).—Used externally.

Allied Compounds.

Alūmnol—Alūmnol—Alumnol.—*Origin.*—This substance was discovered by Filehne of Breslau, and is a mixture of Aluminum Salts of Naphthol-sulphonic Acid, containing about 5 per cent. of aluminum and 15 per cent. of sulphur.

Description and Properties.—It occurs as a light, odorless, white or reddish-white, non-hygroscopic powder. It possesses a sweetish and astringent taste, and is readily soluble in water or glycerin, less so in alcohol, and insoluble in ether.

While becoming darker on exposure to the air, its properties are unaffected. Used externally and locally.

Aluminum Aceto-tartrate.—*Origin.*—First prepared by Athenstadt by dissolving 5 parts of Basic Aluminum Acetate in a sufficient quantity of water by the aid of 2 parts of Tartaric Acid, and evaporating the solution to dryness.

Description and Properties.—It occurs in shining, almost colorless, amorpho masses, with a faint, acetous odor and an acidulous astringent taste. Soluble in wate insoluble in alcohol. Used externally and locally.

Aluminum Boroformate.—*Origin.*—Prepared by heating together Boric Acid Formic Acid, and Alumina.

Antagonists and Incompatibles.—The alkalies and their carbonates; lead, mercury, and iron salts; tartrates and tannic acid.

Synergists.—The vegetable and mineral astringents.

Alūmini Hȳdras—Alūmini Hydrātis—Aluminum Hydrate. *U. S. P.*

Origin.—This substance is found in nature as the rare crystalline mineral *gibbsite* of North America—the *diaspore* of Eastern Europe. The aluminum hydrate may be prepared by precipitating the solution of an aluminum salt with an alkali or alkali carbonate.

Description and Properties.—A white, light, amorphous powder, odorless and tasteless, permanent in dry air. Insoluble in water or alcohol, but completely soluble in hydrochloric or sulphuric acid, and also in potassium or sodium hydrate T. S.

Dose.—3–6 grains (0.2–0.4 Gm.).

Alūmini Sŭlphas—Alūmini Sulphātis—Aluminum Sulphate. *U. S. P.*

Origin.—It is occasionally found as an efflorescence near volcanoes and upon alum-slate. For medicinal use it should be prepared from Aluminum Hydrioxide, by dissolving it in the requisite quantity of Dilute Sulphuric Acid.

Description and Properties.—A white, crystalline powder, having a sweetish and afterward astringent taste; permanent in the air. Soluble in 1.2 parts of water, and much more freely in boiling water; insoluble in alcohol. Used externally.

Description and Properties.—It occurs in pearl-like crystals or crystalline scales, which are very soluble in water. It contains 33.5 per cent. of alumina. Used externally and locally.

Sozal.—*Origin.*—Obtained by dissolving Aluminum Hydrate in Phenol-sulphonic Acid.

Description and Properties.—A crystalline substance having an astringent taste and a faint odor of carbolic acid. It is freely soluble in water, glycerin, and alcohol. Used externally and locally.

Physiological Action.—*Externally and Locally.*—Alum contracts the small blood-vessels and coagulates the albumin in the

tissues, but in order to have any effect it must be applied to a denuded surface. It is also mildly escharotic. Applied to the unbroken skin, it thickens and hardens it.

Internally.—Digestive System.—Its first effect when taken into the mouth is to excite the salivary secretion, the albumin in it, as well as that of the buccal mucous membrane, being precipitated. When its astringent action takes effect the secretions are diminished and the mucous membrane of the mouth and tongue is blanched and puckered. The enamel of the teeth is affected, breaking under its influence.

The digestive juices are diminished in quantity and the pepsin precipitated. Constipation follows, though it may be preceded by a slight diarrhea.

Taken in large doses, alum produces nausea, vomiting, purging, and abdominal pain.

Circulatory System.—Notwithstanding the fact that alum coagulates albumin, it is nevertheless absorbed into the blood-vessels, and by contracting them lessens all the secretions and arrests hemorrhage. When injected directly into the blood it produces thrombi and emboli.

Nervous System.—Spasms are relieved by alum, but this action is in all probability dependent upon contraction of the blood-vessels.

Absorption and Elimination.—As stated, alum is absorbed by the blood-vessels; it is eliminated by the kidneys and liver.

Untoward Action.—The prolonged use of alum is very apt to produce a cough in persons having sensitive bronchi.

Therapeutics.—*Externally and Locally.*—ALUM is used to destroy *exuberant granulations* and *verrucositics*. It is an excellent hemostatic in *epistaxis* and bleeding from the *gums, vagina, rectum, bladder, bites*, and *sockets of extracted teeth.*

It is much used for *sore throat* by public speakers and singers, and is also efficient in *tonsillitis*, particularly the follicular form, *gangrenous pharyngitis, stomatitis ulcerosa, relaxation of the uvula and pharyngeal mucous membrane, swollen and overriding gums*, and *mercurial ptyalism.*

The destructive effect of alum upon the teeth must always be borne in mind: the alum stick or a swab is preferable whenever possible. If a mouth-wash or gargle be necessary, wash and brush the teeth well immediately after using the alum.

Five grains (.32 Gm.) to 1 ounce (30.0 Cc.) of water is an excel-

lent preparation for *ophthalmia*, *conjunctivitis*, and *trachoma*, but must not be used if there is any corneal inflammation, as it is apt to cause ulcers. By adding milk or white of egg to the mixture its efficiency is greatly increased. This preparation is also very serviceable in preventing the discoloration of a "black eye." An injection of 5–10 grains (.32–.64 Gm.) to the ounce (30.0 Cc.) of water is much used in *gonorrhea*, *leucorrhea*, and *gleet*, and also for washing the vulva in *pruritus*.

Sweating of feet, hands, and axillæ, when excessive and fetid, is checked by the application of a lotion or powdered alum.

Soaking a piece of cotton or lint with alum and placing it under an *ingrowing toe-nail* affords marked relief.

Chilblains, *old sores*, and *ulcers* are also benefited by the use of alum.

A spray, gargle, or insufflation has been used with good results in *diphtheria*, *bronchorrhea*, *chronic laryngitis*, *aphonia* due to atony, *bronchitis*, and *whooping cough*.

Internally.—ALUM operates advantageously as an astringent in arresting *gastric* and *intestinal hemorrhages*, *hematuria*, and *menorrhagia*. The *diarrheas of typhoid fever* and *chronic dysentery*, and occasionally the acute forms, are strikingly benefited by an alum enema.

It has been used in *polyuria* and *diabetes mellitus*, though in the later affection it is of little value.

Although alum produces, it also relieves, *constipation* when flatus has existed for some time, and atony of the bowel diminished peristalsis.

Given in emetic doses in *membranous croup*, it loosens the membrane, and as this is expelled it lessens the chance of another one forming by constringing the mucosa and blood-vessels, and thus preventing further exudation.

By checking absorption and producing emesis alum serves as an antidote for *lead-poisoning*, and is an efficient remedy in *lead colic*.

ALUMEN EXSICCATUM is employed chiefly as an escharotic for fungous growths, and to stimulate indolent *ulcers* and mucous membranes with morbid secretions.

Whenever the drug is used as a powder externally or for insufflation, powdered dried alum is the form to use.

Administration.—The emetic dose of alum is 1–2 drachms (4.0–8.0 Gm.) in syrup. Warm water will increase its action when retching begins.

For internal use, 5–10 grains (.32–.64 Gm.), mixed with a little simple syrup or syrup of orange peel to prevent nausea, will be found beneficial. For collyria, 2–3 grains (.12–.20 Gm.) in 1 ounce (30.0 Cc.) of water, or the alum curd, as already mentioned, may serve best. The curd may be separated by adding 2 drachms (8.0 Gm.) of alum to 1 pint (473. Cc.) of milk, boiling, and straining.

The gargle and injection can be used in strengths of 5–20 grains (.32–1.29 Gm.) to 1 drachm (4.0 Gm.). For insufflation the dried alum is employed.

Bismūthi Cĭtras—Bismūthi Citrātis—Bismuth Citrate. *U. S. P.*

Origin.—Bismuth Subnitrate and Citric Acid are boiled in sufficient Water, and the precipitate washed and dried.

Description and Properties.—A white, amorphous or microcrystalline powder, odorless and tasteless, permanent in the air. Insoluble in water or alcohol, but soluble in ammonia water and in solutions of the citrates of the alkalies.

Dose.—1–3 grains (0.06–0.2 Gm.).

Official Preparation.

Bismūthi et Ammōnii Cĭtras—Bismūthi et Ammōnii Citrātis—Bismuth and Ammonium Citrate.—*Origin.*—Prepared by mixing Bismuth Citrate with Distilled Water to make a paste, adding sufficient Ammonia Water to make a solution, filtering, evaporating, and drying on plates of glass.

Description and Properties.—Small, shining, pearly, or translucent scales, odorless, with a slightly acidulous and metallic taste, becoming opaque on exposure to the air. Very soluble in water, but sparingly soluble in alcohol. The product should be kept in well-stoppered bottles, protected from light.

Dose.—1–10 grains (0.06–0.6 Gm.).

Bismūthi Subcarbōnas—Bismūthi Subcarbonātis—Bismuth Subcarbonate. *U. S. P.*

Origin.—Obtained by dissolving purified Bismuth in Nitric Acid and Water, decanting and filtering, mixing with Ammonia Water, washing the precipitate and dissolving in Nitric Acid. The solution is then mixed with a solution of Sodium Carbonate, and the resulting precipitate collected and washed.

Description and Properties.—A white or pale yellowish-white powder, of somewhat varying chemical composition, odorless and tasteless, permanent in the air. Insoluble in water or alcohol, but

completely soluble in nitric or hydrochloric acid, with copious effervescence.

Dose.—5–20 grains (0.3–1.2 Gm.).

Bismūthi Subnītras—Bismūthi Subnitrātis—Bismuth Subnitrate. *U. S. P.*

Origin.—Prepared by dissolving purified Bismuth in Nitric Acid and Water, concentrating by evaporation, adding more water, stirring well, and washing and drying the precipitated bismuth subnitrate.

Description and Properties.—A heavy white powder, of somewhat varying chemical composition, odorless and almost tasteless, permanent in the air. Nearly insoluble in water and insoluble in alcohol, but readily soluble in nitric or hydrochloric acid.

Dose.—5–20 grains (0.3–1.2 Gm.).

Allied Compounds.

Bismūthi Salĭcylas—Bismūthi Salicylātis—Bismuth Salicylate.—*Dose*, 1–20 grains (0.06–1.2 Gm.).

Bismūthi Subiōdidum—Bismūthi Subiōdidi—Bismuth Subiodide.—Used externally.

Bismuth Naphtholate.—*Dose*, 15–30 grains (1.0–2.0 Gm.).

Bismuth Tribromphenate.—*Dose*, 60–75 grains (4.0–5.0 Gm.).

Dĕrmatol (BISMUTH SUBGALLATE).—*Description and Properties.*—A fine saffron-yellow powder, odorless, non-hygroscopic, unaffected by exposure to air or light, insoluble in water, alcohol, or ether.

Dose.—15–30 grains (1.0–2.0 Gm).

Dĕrmol (BISMUTH CHRYSOPHANATE).—*Description and Properties.*—An amorphous yellow powder, neutral in reaction, insoluble in water or alcohol. Used externally and locally.

Thīoform.—A combination of Bismuth, Sulphur, and Salicylic Acid.

Description and Properties.—A light, grayish-yellow powder, odorless and tasteless, insoluble in water, alcohol, or ether. Used externally and locally.

Antagonists and Incompatibles.—The salts of bismuth are insoluble; and should not be prescribed with other agents in solution.

Synergists.—The sedative action of bismuth upon the stomach may be increased by calomel and cerium oxalate, and pepsin may be given as a substitute for this purpose. The astringency of the bismuth salts may be enhanced by opium and tannic acid.

Physiological Action.—*Externally.*—Bismuth salts are mildly astringent, but have no effect upon the unbroken skin.

Internally.—Digestive System.—Bismuth is insoluble in the

gastro-intestinal juices. It coats the mucous membrane, lessening secretions and absorbing excess of free acids, at the same time acting as a sedative and feeble astringent. The tongue and stools are tinged a dark clay color, due to conversion into the sulphide. The soluble salts are absorbed very slowly, and increase the appetite and digestion, constipation being the result.

Circulatory System.—A minute quantity passes into the blood, acting as a tonic.

Nervous System.—Bismuth salts are sedative to the peripheral nerve-endings.

Absorption and Elimination.—The salts of bismuth are absorbed into the circulation, and are eliminated by the urine, liver, and feces.

Untoward Action.—Odier noticed nausea, and Weenesk vomiting, colicky pains, diarrhea, or constipation, headache, sensation of heat, dizziness, and general debility.

Poisoning.—It has always been assumed that cases of poisoning are due to the lead and arsenic contained in the bismuth preparations, but Carnot and Riche found these metals present in such quantities as to be practically inert.

The symptoms are similar to those of lead-poisoning. Large concretions may be found in the intestines, and sloughs in the mouth and gastro-intestinal canal may be present, as well as desquamative nephritis and albuminuria.

Treatment of Poisoning.—Lavage, demulcents, and chemical antidotes for arsenic, magnesium, and calcium; best of all, freshly precipitated hydrated oxide of iron.

Therapeutics.—*Externally and Locally.*—BISMUTH SUBNITRATE is serviceable in *intertrigo*, *erythema*, *acne rosacea*, as a protective dressing for *wounds*, *ulcers*, and *epithelioma*, and as an application for *chapped nipples* and *hands*, relieving the smarting and itching. It is also of use in *fissure*, *prolapsus ani*, and *superficial burns*.

It is used as an injection in *gonorrhea*, *leucorrhea*, and *ozena*, and was formerly used as an insufflation in *acute nasal catarrh*, being abandoned because of the arsenic which it sometimes contains. It serves as a wash in *aphthous stomatitis*, mild cases of *mercurial salivation*, and *cancrum oris*, as well as for the fetid *sweating of feet* and other parts, and for *chancres* and *phlegmonous erysipelas*. It has also proved beneficial in *chronic conjunctivitis* and *granular lids* or *trachoma*.

Internally.—It allays irritation, and is consequently useful in *irritative vomiting* and *diarrhea*. *Gastric pain* is relieved by it.

It is valuable in *pyrosis*, *chronic diarrhea*, *gastric ulcer*, *chronic dysentery*, *diarrhea of typhoid*, early stages of *cholera* and *cholera infantum*, and in the *gastritis* due to alcohol.

The CITRATE OF BISMUTH AND AMMONIUM is very soluble, and should be used only for local applications.

The OXIDE is insoluble, and combined with morphine has been used as a snuff in *ozena* and *nasal catarrh*.

SUBCARBONATE OF BISMUTH is not used in medicine.

SALICYLATE OF BISMUTH reduces the pulse and temperature in *typhoid fever*, and also corrects the fetid stools.

BISMUTH SUBGALLATE, or DERMATOL, was first used by Heintz and Liebrecht, being intended as a substitute for iodoform; but it is very astringent, although not irritating. The preparation is used in *weeping eczema*, *otitis media*, *herpes*, *wounds*, *burns*, *diarrhea*, and *dysentery*. In *stagnant ulcers* it is of no service, since they need stimulation.

BISMUTH CITRATE is insoluble, and is of no service medicinally.

Besides the foregoing preparations there is a TANNATE OF BISMUTH, used to some extent in *diarrhea*, *gonorrhea*, *leucorrhea*, and *ophthalmia*.

PHOSPHATE OF BISMUTH is the least soluble of all the bismuth compounds, and is used, but rarely, in *diarrhea*, *dysentery*, *gastralgia*, and *dyspepsia*.

SUBIODIDE OF BISMUTH is used as a substitute for the subnitrate, and is of special value in *chronic ulcers*. It is supposed to be slightly anesthetic.

VALERIANATE OF BISMUTH is of no medicinal value.

SUBBENZOATE OF BISMUTH is mildly escharotic.

Administration.—The drug is used externally as a powder or ointment in combination with naphthalin or vaseline, to which a little morphine may be added. Belladonna, opium, and oleate of bismuth are also used.

For gastralgia and dyspepsia, pepsin or magnesium and calcium phosphate may be combined with bismuth. If a cathartic is desirable, rhubarb may be added.

Bismuth, aromatic powder, and carbo ligni make an excellent combination in flatulent dyspepsia.

In infantile diarrhea and summer complaint bismuth 1 grain (.06 Gm.), syrupus aurantii 15 minims (.92 Cc.), and calumba 15 minims (.92 Cc.) are efficacious, particularly as they allay the alternating pain.

Bismuth, 5–15 grains (.32–1.0 Gm.), is given for stomach affections, and 15 grains (1.0 Gm.) to 1 drachm (4.0 Gm.) for intestinal disorders, one to two hours after meals as the stomach is emptied.

Cērii Ŏxalas—Cērii Ŏxalātis—Cerium Oxalate. *U. S. P.*

(CEROUS OXALATE.)

Origin.—Prepared by a complicated process by the action of acids, etc. upon the powdered mineral.

Description and Properties.—A white, granular powder, without odor or taste, and permanent in the air. Insoluble in water, alcohol, or ether.

Dose.—1–8 grains (0.06–0.5 Gm.).

Physiological Action.—The physiological action of this drug is imperfectly understood: it is supposed to be a nervous and gastric sedative.

Therapeutics.—*Internally.*—Its widest application is in the *vomiting of pregnancy*, but it also controls the *emesis of uterine disease* and of *dyspepsia*, due to gastric acidity or deranged innervation of the stomach, as in sea-sickness.

It does not derange digestion, and is therefore of value in checking the *cough of phthisis* and *bronchitis*, especially when accompanied by vomiting.

Simpson regarded it as almost a specific in *chorea*. In combination with bismuth it is useful in checking *diarrhea*.

Administration.—Cerium oxalate is usually administered in pill form, 1–3 grains (.06–.20 Gm.) three times daily, but the powder is used when the drug is associated with other remedies.

TOPICAL REMEDIES.

GROUP XVIII.—CAUSTICS OR ESCHAROTICS.

CAUSTICS are medicines which destroy the tissues to which they are applied. They excite inflammation and vascular dilatation of the surrounding area. The eschar produced by these drugs is separated from the living tissues by the inflammation and suppuration produced.

When a drug acts as a caustic—that is, when it destroys a circumscribed portion of living tissue—it penetrates deeper in proportion as the product of its action (*i. e.* the eschar) is looser, and is shallower in proportion as the eschar is firmer or more compact. This is the essential difference between Astringents and Caustics: the former contract the tissues, causing the protoplasm to be firmer and occupy less space; the latter cause the protoplasm to be softer and occupy more space. It will be seen, therefore, that the more caustic a drug is, the less astringent it is, and *vice versâ*.

The caustic action of a drug depends upon whether the drug and its products are both soluble in water; for if the medicine is not soluble in water, it cannot have a caustic action, and if the products of the caustic action are not soluble in water, the eschar will be firm, the drug acting more as an astringent than as a caustic.

For example, the chlorides of the heavy metals, such as mercuric chloride, zinc chloride, etc., are usually freely soluble in water, and are, as a rule, the most caustic of the metallic salts. Should a metallic chloride be insoluble in water, it will have no caustic action—*e. g.* silver chloride.

If the heavy metals be arranged in a series, placing at one end the most astringent salts, and at the other the least astringent, it will be noticed that those salts which are the least astringent are the most caustic, becoming less and less caustic as they are more and more astringent.

Most Astringent. *Least Astringent.*

Lead, Iron, Zinc, Copper, Silver, Tin, Mercury.

Least Caustic. *Most Caustic.*

Caustics act—

1. By abstracting the water of the tissues;
2. By combining with the albumin of the tissues;
3. By corrosive oxidation.

The important caustics, arranged according to their mode of action, are enumerated below.

Caustics which act by abstracting the water from the tissues:

Arsenious Acid,	Potassa and Lime,
Antimony Chloride,	Caustic Soda,
Carbolic Acid,	Glacial Acetic Acid,
Chromic Acid,	Lime,
Caustic Potash,	Mineral Acids.

Caustics which act by combining with the albumin of the part:

Alum (burnt),	Mercuric Oxide,
Copper Sulphate,	Silver Nitrate,
Mercuric Chloride,	Zinc Chloride,
Mercuric Nitrate,	Zinc Sulphate.

Caustic which acts by corrosive oxidation:

Bromine.

Caustics are employed—

1. To destroy excrescences on the skin or mucous membranes, and to effect the destruction or removal of malignant growths, as in cases of *warts*, *condylomata*, *polypi*, *lupus*, *epithelioma*, etc.;

2. To open abscesses, or to maintain a chronic irritation, or to stimulate *indolent sinuses*, *ulcers*, etc.;

3. To destroy and prevent the absorption of the virus from the *bites of rabid and venomous animals*, and for the destruction of *chancres* and *malignant pustules*.

Those escharotics which have not been discussed elsewhere will now be considered in detail:

Līquor Antimōnii Chlōridi—Liquōris Antimōnii Chlōridi—Solution of Antimony Chloride. (Unofficial.)

(Butter of Antimony.)

Origin.—Prepared by the action of Hydrochloric Acid upon Purified Black Antimony.

Description and Properties.—A yellowish or yellowish-red liquid, having the specific gravity 1.47, and yielding with water a white precipitate of antimonious oxychloride (*powder of Algaroth*).

Used externally as a caustic.

Physiological Action and Therapeutics.—SOLUTION OF ANTIMONY CHLORIDE is one of the most powerful caustics employed in surgery. It is a violent corrosive poison, toxic doses producing complete general collapse, corroding and charring any living tissue with which it comes in contact. The treatment of poisoning by butter of antimony would be—chalk, magnesia, demulcent drinks, tannic acid, anodynes, and stimulants if necessary.

SOLUTION OF CHLORIDE OF ANTIMONY may be used as a caustic for the *bites of rabid animals* and *venomous reptiles, chancres, condylomata, malignant pustules*, etc.

The preparation should be cautiously applied with a camel's-hair pencil.

Ăcidum Chrōmicum—Ăcidi Chrōmici—Chromic Acid. *U. S. P.*

(CHROMIC TRIOXIDE; CHROMIC ANHYDRIDE.)

Origin.—Dissolve Potassium Bichromate in Sulphuric Acid and Water; decant, heat with more Sulphuric Acid; cool, and crystallize.

Description and Properties.—Small, needle-shaped crystals or rhombic prisms, of a dark purplish-red color and metallic luster; odorless; destructive of animal and vegetable tissues; deliquescent in moist air. Very soluble in water, forming an orange-red solution. When brought in contact with alcohol, ether, glycerin, and other organic solvents decomposition takes place, sometimes with dangerous violence. Chromic acid should be kept in glass-stoppered bottles, and great caution should be observed to avoid bringing it in contact with organic substances, such as cork, tannic acid, sugar, alcohol, etc., as dangerous accidents are liable to result. Used externally.

Physiological Action and Therapeutics.—Chromic acid is a powerful caustic, deodorant, and disinfectant. It coagulates albumin and oxidizes organic matter. Its action is slow, and the pain following its application is usually of shorter duration than that of most caustics. Weak solutions are stimulant, astringent, and alterative.

Chromic acid is used in the form of a paste or in solutions of various strengths for the removal of *syphilitic warts, vegetations, condylomata*, etc. As a caustic and stimulant application in many diseases of ear, nose, and throat it serves a valuable purpose, as in *nasal polypi, enlarged tonsils, chronic and syphilitic laryngitis, laryn-*

geal papillomata, chronic superficial glossitis, tuberculosis of the tongue, ozena, ulcerations of the mouth, etc.

A 10 per cent. solution of chromic acid has been found serviceable in the treatment of *hyperidrosis*.

A solution of 1 part of chromic acid in 40 parts of water makes an efficient lotion for disinfecting *foul ulcers* and as an injection in *gonorrhea, leucorrhea*, etc.

Sessile piles and *salivary fistulæ* are efficiently treated by touching the parts with pure chromic acid.

Potăssa—Potăssæ—Potassa. *U. S. P.*

(Potassium Hydrate; Potassium Hydroxide; Caustic Potash.)

Origin.—Prepared by evaporating Liquor Potassæ, fusing the residue, and pouring into clean cylindrical moulds which have been previously warmed.

Description and Properties.—Dry, white, translucent pencils, or fused masses, hard and brittle, showing a crystalline fracture; odorless or having a faint odor of lye, and of a very acrid and caustic taste. Because of its active effect upon organic tissues it should be tasted and handled with exceeding care. Exposed to the air, it rapidly absorbs carbon dioxide and moisture, and deliquesces. Soluble in about 0.5 part of water and in 2 parts of alcohol. Potassa should be kept in well-stoppered bottles made of hard glass. Used externally.

Potăssa cum Călce—Potăssæ cum Călce—Potassa with Lime. *U. S. P.*

(Vienna Caustic or Vienna Paste.)

Origin.—Prepared by rubbing together equal parts of Potassa and Lime in a warm iron mortar.

Description and Properties.—A grayish-white powder, deliquescent, having a strongly alkaline reaction. Used externally.

Sōda—Sōdæ—Soda. *U. S. P.*

(Sodium Hydrate; Sodium Hydroxide; Caustic Soda.)

Origin.—Prepared from a solution of Soda in the same manner as described under Potassa.

Description and Properties.—Dry, white, translucent pencils or fused masses, showing a crystalline fracture, odorless, and having an acrid and caustic taste. Great caution is necessary in

tasting and handling it, as it rapidly destroys organic tissues. Exposed to the air, it rapidly deliquesces, absorbs carbon dioxide, and becomes covered with a dry coating of carbonate. Soluble in 1.7 parts of water, very soluble in alcohol. Soda should be kept in well-stoppered bottles made of hard glass. Used externally.

Physiological Action and Therapeutics.—POTASSA is one of the strongest and most penetrating caustics known. It possesses the property of abstracting water from the tissues, neutralizing free acids, decomposing nitrogenous compounds, and of forming solutions of fibrin, albumin, and gelatin.

When applied to the soft tissues it occasions severe pain, and produces a moist, ashen, and then black, leathery slough, which leaves a granulating ulcer behind it.

When potassa is taken internally in immoderate doses it produces all the symptoms of corrosive poisoning. Small doses, freely diluted, have the same action as the alkalies.

As a caustic, potassa is used for the same purposes as the caustics previously described.

POTASSA WITH LIME in its operation is similar to, but milder than, potassa.

The action and therapeutics of SODA are identical with those of potassa, save that soda is less depressing to the heart, muscular and nervous systems. It is not used so much as potassa, the latter preparation usually being preferred as a caustic.

To limit the caustic action of these drugs a piece of adhesive plaster should be applied first, with an aperture of the size desired. Upon the skin exposed in the hole in the plaster the caustic is placed, the skin having been previously moistened. The caustic action may be arrested at any time by wetting the part with vinegar.

Ăcidum Acēticum Glaciāle—Ăcidi Acētici Glaciālis—Glacial Acetic Acid. *U. S. P.*

Origin.—Prepared by distilling dry Sodium Acetate with strong Sulphuric Acid.

Description and Properties.—A clear, colorless liquid, of a strong, vinegar-like odor, and a very pungent, purely acid taste. Its specific gravity at 15° C. (59° F.) should not be higher than 1.058, corresponding to at least 99 per cent. of absolute acid. Used externally.

Physiological Action and Therapeutics.—Glacial acetic acid is a powerful corrosive poison, having an action similar to that of the

mineral acids. The drug is principally used as a caustic for the removal of *warts* and *corns*, and occasionally for *blistering the skin.*

Călx—Călcis—Lime. *U. S. P.*

Origin.—Obtained by burning White Marble, Oyster Shells, or the purest varieties of natural Calcium Carbonate.

Description and Properties.—Hard, white or grayish-white masses, which, in contact with air, gradually attract moisture and carbon dioxide, and fall to a white powder; odorless; of a sharp, caustic taste. Soluble in about 750 parts of water; insoluble in alcohol. Used externally.

Physiological Action and Therapeutics.—Quicklime when used undiluted is caustic, producing effects similar to those described under Potassa.

For caustic purposes it is usually mixed with potassa (potassa cum calce). When lime is given in diluted solution, it acts as an astringent and antacid. (See Liquor Calcis, p. 155.)

The conditions for which lime is employed as a caustic are mentioned under Potassa.

Zĭnci Chlōridum—Zĭnci Chlōridi—Zinc Chloride. *U. S. P.*

Origin.—Prepared by dissolving Zinc in boiling Hydrochloric Acid. To the solution is added first Nitric Acid, then Zinc Carbonate to precipitate the impurities. Filter and finally evaporate.

Description and Properties.—A white, granular powder or porcelain-like masses, irregular or moulded into pencils; odorless; of such intensely caustic properties as to make tasting dangerous, unless the salt be dissolved in much water, when it has an astringent, metallic taste. Very deliquescent; soluble in about 0.3 part of water, forming a clear solution; very soluble in alcohol. Zinc chloride should be kept in small, glass-stoppered bottles.

Used externally.

Physiological Action and Therapeutics.—ZINC CHLORIDE is caustic, antiseptic, disinfectant, excitant, astringent, and slightly hemostatic, according to the strength of the preparation. Its caustic action is painful, yet, while the drug penetrates very deeply, limited to the seat of application.

Poisoning by zinc chloride is evidenced by all the symptoms produced by a violent corrosive irritant poison.

The drug formerly enjoyed quite a reputation as a remedy for *cancer*, especially *epithelioma*, in which case it was used in the form of "caustic arrows" inserted in the base of the growth so as to separate it from the healthy tissues.

It is used as a paste and lotion for *morbid growths*, *lupus exedens*, *putrid ulcers*, *nævi*, and *syphilitic sores*.

SOLUTIONS OF ZINC CHLORIDE are injected into *polypi* and *scrofulous glands*, and for the destruction of the *pulp of decayed teeth*.

A weak solution of zinc chloride is an efficient injection in *gonorrhea*, *leucorrhea*, and *hemorrhagic endometritis*.

For caustic purposes the ZINC CHLORIDE itself may be used, or a paste prepared with starch, gypsum, flour, anhydrous sulphate of lime, or powdered althea. MAYET'S PASTE consists of zinc chloride 8 parts, zinc oxide 1 part, dried wheat flour 7 parts, and water 1 part. The cuticle must always be removed before applying the paste, strong water of ammonia answering for this purpose.

Brōmum—Brōmi—Bromine. *U. S. P.*

Origin.—It is found both in sea-water and in saline springs, but is chiefly obtained from the mother-liquors of salt-works in the United States and at Strassfurth, Germany.

Description and Properties.—A heavy, dark brownish-red, mobile liquid, evolving, even at ordinary temperatures, a yellowish-red vapor, highly irritating to the eyes and lungs, and having a peculiar suffocating odor, resembling that of chlorine. Soluble in 30 parts of water and readily soluble in alcohol or ether. Bromine should be kept in glass-stoppered bottles, in a cool place.

Used externally.

Physiological Action and Therapeutics.—BROMINE is a powerful corrosive irritant, the fumes of which occasion severe irritation of the eyes and respiratory passages, with cough, hoarseness, and dyspnea. When taken into the stomach it produces all the symptoms of corrosive poisoning.

The drug is an active caustic, deodorant, and disinfectant. It was formerly extensively employed, particularly during the Civil War of the United States, for the treatment of *hospital gangrene*, for which it is a most efficient remedy. Bromine has also been used as an injection (1 part to 3 of alcohol) in various forms of *cancer*. Owing to the pain attending the operation, however, the treatment has not been generally adopted.

Bromine is an efficient disinfectant, and has been employed to

disinfect and deodorize the atmosphere of hospitals, etc. Berlin sanitary officials declare that "$3\frac{1}{2}$ ounces of bromine can disinfect a space of 918 cubic feet, and deodorize a space of 7000 cubic feet."

GROUP XIX.—VESICANTS AND EPISPASTICS.

THESE are drugs which excite more or less local inflammation when applied to the skin; the inflammatory condition is accompanied by an effusion of serum between the epidermis and dermis—*i. e.* a *blister.*

The principal Vesicants are—

Acetic Acid (glacial),	Mezereon,
Ammonia (the confined vapor),	Mustard (volatile oil),
Cantharides,	Rhus Toxicodendron.
Iodine,	

There are certain drugs which affect certain parts of the skin—for instance, the orifices of the sudoriferous glands—in a special manner, and their action on these parts is such as to give rise to *pustules* rather than blisters. Drugs which affect the skin in this manner are called PUSTULANTS. The following-named drugs are the most important of them:

Croton Oil,	Silver Nitrate,
Tartar Emetic,	Ipecac.

Therapeutics.—VESICANTS are employed as local stimulants in *chronic ulcers* and to facilitate the absorption of effusions, as in *chronic synovitis* or *chronic thickening about the joints.*

Blisters are also of use in *endocarditis, neuralgias, sciatica, chronic pericarditis, pleurisy, hysterical paralysis,* and *aphonia, cerebral* or *spinal meningitis,* etc.

PUSTULANTS are more particularly employed to maintain a continuous though moderate irritation in chronic inflammations. They are but rarely used for the same class of cases as vesicants, but are preferable when it is desirable to prolong the local irritation without exciting too much inflammation.

Contraindications.—Vesicants are usually contraindicated in *acute* inflammations and in inflammation of the cutaneous tissues, as rubeola and scarlatina. Vesicants are not permissible in pregnancy, debility, scorbutus, and purpura, or in extreme infancy and old age. They should not be applied over the scrotum or the

mammary glands, nor over bony prominences where the healing processes are apt to be retarded.

All the vesicants and pustulants have, with two exceptions, been discussed elsewhere.

Cănthăris—Canthăridis—Cantharides. *U. S. P.*

(Spanish Flies.)

Origin.—*Cantharis vesicatoria* De Geer, a beetle indigenous to Southern and Central Europe, and found eastward as far as Western Asia.

Description and Properties.—About 1 inch (25 Mm.) long and ¼ inch (6 Mm.) broad; flattish-cylindrical, with filiform antennæ, black in the upper part, and with long wing-cases and ample, membranous, transparent, brownish wings, elsewhere of a shining, coppery-green color. The powder is grayish-brown, and contains green shining particles. Odor strong and disagreeable; taste slight, afterward acrid.

Cantharides contains a fatty crystallizable body, *cantharidin*, which is the active principle, a volatile oil also possessing vesicatory properties, and a green oil closely allied to chlorophyl.

Used externally.

Official Preparations.

Cerātum Canthăridis—Cerāti Canthăridis—Cantharides Cerate.—Cantharides, 320; Yellow Wax, 180; Resin, 180; Lard, 220; Oil of Turpentine, 150.—Used externally.

Collōdium Cantharidātum—Collōdii Cantharidāti—Cantharidal Collodion (Blistering Collodion).—Used externally.

Tinctūra Canthăridis—Tinctūræ Canthăridis—Tincture of Cantharides.—*Dose*, 1–15 minims (0.06–1.0 Cc.).

The Cantharides Cerate is an ingredient of **Emplastrum Picis Cantharidatum.**

Antagonists and Incompatibles.—There are no known physiological antagonists or incompatibles.

Synergists.—Members of this group enhance the vesicating action of cantharides. Its aphrodisiac action is aided by phosphorus and strychnine.

Physiological Action.—*Externally and Locally.*—Cantharides is a slow though very powerful irritant. When the drug is applied to the skin or mucous membrane it excites a tingling, burning pain, with marked redness of the cuticle. In the course of three or four hours after the application of cantharides there are formed numer-

ous vesicles which soon coalesce, forming one large bleb full of clear serum.

The drug not only causes vascular dilatation of the part to which it is applied, but reflexly dilates the blood-vessels of the deep-seated organs underneath, thus acting as a counter-irritant.

The active principle of cantharides may be absorbed through the skin, producing its constitutional effects.

Internally.—Digestive System.—Moderate doses of cantharides produce a sensation of heat in the stomach, and may even occasion gastrodynia. Large amounts occasion severe gastro-intestinal irritation. There is a sense of constriction in the esophagus, a burning heat in the throat, ptyalism, intense gastric pain, nausea, and vomiting of glairy mucus often containing blood. There is great tenderness over the abdomen, fibrinous and sometimes bloody stools, attended by griping pain and tenesmus.

Circulatory System.—Full medicinal doses excite the heart, increasing the force and rapidity of its action, and elevate arterial tension. Under large doses the pulse and arterial pressure fall, and there is great depression of the entire circulatory system.

Nervous System.—Small doses have no influence on the nervous system other than would be produced by stimulation of the circulation. Excessive amounts have produced marked cerebral effects, consisting of partial or general convulsions, coma, and insensibility.

Respiratory System.—No effect follows medicinal doses; toxic amounts accelerate and weaken the respiration.

Absorption and Elimination.—The active principle of cantharides is rapidly absorbed into the blood, and in large doses produces marked irritation of the genito-urinary organs. There is at first increase of urine, which is soon greatly diminished in amount, and which may be albuminous or bloody. There is strangury and frequent desire to micturate, and severe pain in the loins and bladder. The local irritation is apt to occasion priapism, with frequently erotic excitement and seminal emissions. There may also be swelling and inflammation of the external genitals. In women cantharides may also occasion increased sexual desire, cause abortion, or induce menstruation. Yet amatory desire does not always follow the ingestion of cantharides, even in large doses. Indeed, the aphrodisiac effect of the drug is usually more manifest under small or full medicinal doses than from the ingestion of immoderate amounts. The drug is principally eliminated by the kidneys.

Temperature.—The temperature is at first elevated by excessive amounts, but declines together with the depression of the circulatory system.

Uterus.—The uterus and female genital organs are stimulated by the drug, as has been previously described.

Untoward Action.—The untoward manifestations do not differ from the symptoms produced by excessive amounts, as described under the different systems. These various untoward effects vary in intensity according to the individuality of the patient.

Poisoning.—Toxic amounts of cantharides produce violent gastro-intestinal and genito-urinary inflammation. The general symptoms are great pain in the throat, stomach, and bowels, excessive thirst, vomiting of bloody mucus, frequent stools which may contain blood, burning pain in the kidneys, strangury, scanty, albuminous, and bloody urine, painful erections of the penis, seminal emissions, swelling and inflammation of the external genitals, a rapid, small, and weak pulse, accelerated respiration, skin hot and dry, congestion of the face, pain in the head, delirium, trembling, partial or general convulsions, and coma. The post-mortem appearances are swelling, ecchymoses, and sometimes gangrene of the mucous membrane of the alimentary canal. The kidneys are enlarged and engorged, and are in a condition of parenchymatous and desquamative nephritis.

Treatment of Poisoning.—The stomach should be emptied, and demulcents, stimulants, and opiates given as necessary. Oils and fats should be avoided, as they increase the solubility and favor the absorption of cantharidin.

Therapeutics.—*Externally and Locally.*—A CANTHARIDAL BLISTER is frequently of service as a revulsive when there is a local tendency to congestion. The drug is applied to the chest in the second stage of *pneumonia* and in *pleurisy*, and "flying" blisters are beneficial in *hydrothorax* and *chronic pleurisy*.

The cure of *boils* and *carbuncles* has been hastened by applying a cantharidal blister to the indurated spot.

The drug is also of service to stimulate indolent *ulcers*, *fistulæ*, etc.

A blister over the region of the heart will often afford marked relief in *pericarditis*.

A CANTHARIDAL PLASTER applied over the course of the affected nerve frequently affords great relief from pain in *neuralgia* and some forms of *sciatica*.

In subacute or chronic inflammatory *diseases of the brain and spinal cord*, such as meningitis, blisters applied to the nape of the neck or along the course of the cord, a little to one side of the vertebræ, will often favorably influence the course of the disease.

Blisters are frequently of service in *synovitis* and *periostitis* of the larger bones. A blister applied to the epigastrium will sometimes allay *gastric pain* and *obstinate vomiting*.

Blistering over the region of the ovary is an efficient means of relieving the symptoms of *chronic ovaritis*, and a blister applied to the mastoid region will frequently be of benefit in *otitis media*.

Small patches of *tinea tonsurans* and of *tinea circinata* may be removed by blistering.

Liniments and lotions containing TINCTURE OF CANTHARIDES are among the best means of curing *alopecia*.

The National Dispensatory aptly gives the general uses for cantharides in the form of blisters as follows: "1, to stimulate the whole or a particular part of the system; 2, to promote the absorption or prevent the accumulation of inflammatory exudations; 3, to recall suppressed discharges; 4, to act as a depletory; 5, to promote the cure of internal diseases by counter-irritation of the skin."

Internally.—Certain diseases of the genito-urinary organs, as *debility of the bladder* with accompanying *incontinence of urine*, *chronic pyelitis*, *chronic catarrh of the bladder*, etc., are benefited by small doses of TINCTURE OF CANTHARIDES.

Small doses of this preparation are sometimes serviceable in the treatment of *acute desquamative nephritis*. *Diabetes insipidus* has been arrested by the internal administration of cantharides.

Gleet, *prostatorrhœa*, and *spermatorrhœa* are benefited by this drug. *Menorrhagia* and *amenorrhœa* occurring in debilitated women will often be benefited by cantharides.

Tincture of cantharides, with tincture of iron, tincture of nux vomica, and phosphoric acid, is an efficient combination in *impotence*, the result of old age, sexual excesses, or masturbation.

In *scaly skin diseases* cantharides often proves very serviceable after arsenic and the external application of tarry preparations have failed.

CANTHARIDIN and POTASSIUM CANTHARIDATE have been recommended by Professor Liebreich as efficient remedies in *tuberculosis*.

Hypodermic injections not exceeding $\frac{1}{100}$ grain (0.0006 Gm.) of CANTHARIDIN are used, and in some cases apparently have been

followed by good results. The treatment, however, has not proved sufficiently successful to warrant its employment to the exclusion of other measures.

Administration.—A cantharidal blister should not be allowed to remain on the skin for more than twelve or twenty-four hours, six to eight hours usually being sufficient.

When blebs are formed, they should be carefully opened at their most dependent parts. When the serum has drained away the part should be dressed with a layer of borated cotton kept in place by the aid of a few strips of adhesive plaster. Should the blistering by cantharides occasion too great pain, a poultice made of breadcrumb and solution of subacetate of lead, to which is added $\frac{1}{8}$ or $\frac{1}{4}$ grain (0.008 or 0.01 Gm.) of morphine sulphate or other soothing application, should be applied to the blistered part. The obstinate ulcers which sometimes follow the use of cantharides blisters may be treated effectively by Goulard's cerate.

It is said that the strangury which plasters of cantharides frequently cause may be prevented by sprinkling the surface of the plaster with powdered camphor or sodium bicarbonate.

For internal use the tincture of cantharides is the only preparation to employ.

Sīnapis Ălba—Sīnapis Ălbæ—White Mustard. *U. S. P.*

Origin.—The seed of *Brassica alba* L., Hooker filius et Thompson.

Sīnapis Nīgra—Sīnapis Nīgræ—Black Mustard. *U. S. P.*

Origin.—The seed of *Brassica nigra* L., Koch.

Both the white and black mustard are annual plants, indigenous in Southern Europe and Western Asia, cultivated, and sometimes found wild, in the United States.

Description and Properties.—WHITE MUSTARD SEEDS are almost globular, about $\frac{1}{12}$ inch (2 Mm.) in diameter, with a circular hilum; testa yellowish, finely pitted, hard; embryo oily, with a curved radicle and two cotyledons, one folded over the other; free from starch; inodorous; taste pungent and acrid.

BLACK MUSTARD SEEDS resemble the preceding in shape, but have a diameter only of $\frac{1}{25}$ inch (1 Mm.); blackish-brown or deep red-

dish-brown, with a testa covered with shallow pits, and when crushed and macerated with water acquiring a strong and pungent odor.

WHITE MUSTARD SEED contains an almost tasteless, yellowish, fixed oil, and a substance known as *sinalbin*, which is the chief constituent. This substance may be converted into *sulphocyanate of acrinyl* (the volatile oil of mustard) by the action of the ferment *myrosin* and water. BLACK MUSTARD SEEDS contain the same fixed oil as the white mustard, and a glucosid, *sinigrin*, which by the action upon it of myrosin in contact with water converts it into *allyl sulphocyanide* (a volatile oil). To this volatile oil of mustard, which is official, are due both the pungent taste and odor of the moistened powder.

Dose.—1–4 drachms (4.0–15.0 Gm.).

Official Preparation (of Black Mustard Seed).

Chărta Sĭnapis—Chărtæ Sĭnapis—Mustard Paper.

Ōleum Sĭnapis Volătile—Ōlei Sĭnapis Volătilis—Volatile Oil of Mustard. *U. S. P.*

Origin.—A volatile oil obtained from Black Mustard by maceration with Water and subsequent distillation.

Description and Properties.—A colorless or pale yellow, limpid, and strongly refractive liquid, having a very pungent and acrid odor and taste. Freely soluble in alcohol, ether, or carbon disulphide. Used externally.

Official Preparation.

Linimĕntum Sĭnapis Compŏsitum—Linimĕnti Sĭnapis Compŏsiti—Compound Liniment of Mustard.—Formula: Volatile Oil of Mustard, 30; Fluid Extract of Mezereum, 200; Camphor, 60; Castor Oil, 150; Alcohol, to 1000, by solution. Used externally.

Physiological Action.—*Externally and Locally.*—Mustard is irritant, counter-irritant, rubefacient, and vesicant. Any degree of irritation, from slight redness of the skin to severe blistering, may be produced by mustard. It is more rapid in its action than cantharides, and when applied to the skin there is produced almost immediately a sensation of warmth, which rapidly passes into a severe burning pain. This irritation of the sensory nerves is succeeded by paralysis and more or less loss of sensation, so that if mustard be allowed to remain on the skin until blistering ensues there is a decided diminution of pain.

The local application of mustard reflexly stimulates the heart and respiration.

Internally.—Mustard in small amounts is taken as a condiment, and is a powerful stimulant of the gastro-intestinal tract. Large doses irritate the stomach and act as an emetic, producing prompt emesis without depression, owing to the reflex stimulation of the heart and respiration.

The volatile oil of mustard is never intentionally given internally. It is a powerful caustic irritant, a single drop upon the tongue producing an intense burning pain in the throat, stomach, and nose.

Therapeutics.—*Externally and Locally.*—MUSTARD may be used locally for the same purposes as cantharides, being superior to the latter-named drug when a simple rubefacient effect is desired. Mustard when applied locally is more of a stimulant to the circulatory and respiratory systems than cantharides, and is therefore an efficient remedy in *syncope*, *asphyxia*, and *coma*.

As a stimulant in these conditions, a large MUSTARD POULTICE is applied to the legs.

A MUSTARD BATH, in the strength of 1 drachm (4.0 Gm.) to 1 gallon (3785.43 Cc.) of water, is an efficient means of breaking up a *cold*, and if properly used is of service when the rash in *measles* or *scarlet fever* has receded.

The *menses* may often be re-established when suppressed by a MUSTARD SITZ-BATH, taken at the time of the expected period.

Internally.—Other than the use of mustard as a condiment, the drug is given only to produce vomiting, being one of the best emetics in *indigestion* and *narcotic poisoning*.

Obstinate *hiccough* has sometimes been arrested by an INFUSION OF MUSTARD.

Administration.—A mustard plaster, or sinapism, is prepared by mixing equal parts of wheaten or rye flour with water to the consistence of a thick paste, which is spread on linen or cotton cloth and applied to the skin. A dampened piece of gauze interposed between the plaster and the skin will prevent the former from adhering.

A mustard cataplasm is a weaker preparation. A flaxseed or cornmeal poultice is made, to which a small quantity of ground mustard is added. This is intended to maintain a gentler but more prolonged action than the *sinapism*.

"Mustard leaves," or plasters which may be obtained ready pre-

pared at drug-stores, are intended to be simply dipped in water and applied to the skin. Their activity may be lessened by interposing a thin piece of linen or cotton cloth between the plaster and the skin.

Liniments containing oil of mustard are efficient rubefacients, care being taken to adapt the strength of the preparation to the delicacy of the skin.

When mustard is taken as an emetic, it is given in the form of an infusion, in the proportion of 1, 2, or 3 drachms (4.0, 8.0, or 12.0 Gm.) to 1 pint (473.17 Cc.) of water.

A preparation known as *mustard whey* is sometimes given. It is prepared by boiling 1½ ounces (46.65 Gm.) of bruised mustard seed in a mixture of 1 pint (473.17 Cc.) of milk and 1 quart (946.35 Cc.) of water, until it is curdled, when the whey should be strained off.

GROUP XX.—RUBEFACIENTS.

THESE are drugs which, when locally applied, are intended to produce temporary redness and congestion of the skin. Some of them are vesicant if applied in full strength, and if their contact with the skin be sufficiently prolonged, vesication, or even total destruction of tissue, may result.

The following list embraces the principal rubefacient drugs:

Ammonia,
Alcohol,
Arnica,
Camphor,
Capsicum,
Chloroform,
Ether,
Iodine,
Menthol,
Mezereon,
Mustard,
Oil of Cajuput,
Oil of Turpentine,
Pitch,
Volatile Oils.

Hot water and friction are also rubefacient agents.

Rubefacients are used for their influence upon the skin itself or for their effect on deep-seated structures.

Rubefacients are efficient means of relieving *neuralgic pains*, conditions of *nervous debility*, *nervous excitement*, the *sense of fatigue*, and as an aid in *narcotic poisoning*, also to hasten the *absorption of inflammatory exudates*, to remove the swelling and restore the function of *chronically inflamed joints*, etc.

Rubefacients should ordinarily be applied with friction, as rubbing of the skin aids the action of many of them.

Save one, all the rubefacients mentioned in the preceding list have been considered elsewhere in the present work.

Pix Burgŭndica—Pīcis Burgŭndicæ—Burgundy Pitch. *U. S. P.*

Origin.—The prepared resinous preparation of *Abies excelsa* Poiret, the spruce fir, or Norway spruce, a stately tree growing in Northern Asia and Northern Europe, and frequently cultivated in the United States.

Description and Properties.—Hard, yet gradually taking the form of the vessel in which it is kept, brittle, with a shining, conchoidal fracture, opaque or translucent, reddish-brown or yellowish-brown; odor agreeably terebinthinate; taste aromatic, sweetish, not bitter. It is almost entirely soluble in glacial acetic acid or in boiling alcohol, and partly soluble in cold alcohol.

Burgundy pitch contains a resin and a volatile oil in variable proportion.

Used externally.

Official Preparations.

Emplăstrum Pīcis Burgŭndicæ—Emplăstri Pīcis Burgŭndicæ—Burgundy Pitch Plaster.—Contains 90 per cent. of Burgundy Pitch. Used externally.

Emplăstrum Pīcis Cantharidātum—Emplăstri Pīcis Cantharidāti—Cantharidal Pitch Plaster (WARMING PLASTER).—Contains 8 per cent. of Cerate of Cantharides. Used externally.

Burgundy Pitch is contained in **Emplăstrum Fĕrri** and **Emplăstrum Ōpii.**

Physiological Action and Therapeutics.—Burgundy pitch when applied to the skin in the form of a plaster occasions redness and a papular eruption, accompanied by itching. If the plaster is allowed to remain in contact with a delicate skin for too long a period, there may be produced a vesicular or even pustular eruption.

The chief uses of Burgundy pitch plaster are to protect, sustain, or stimulate the part to which it is applied.

The plaster is an efficient remedy in *subacute* and *chronic pleurisy, chronic bronchitis, lumbago, muscular rheumatism*, etc.

Before applying a Burgundy pitch plaster to a hairy skin, the hair should be shaved off. The removal of the plaster may be facilitated by warming it, applying to the back of the plaster a hot water-bag. Any particles of pitch which may

adhere to the surface of the skin may be removed by washing with warm alcohol.

GROUP XXI.—EMOLLIENTS, DEMULCENTS, AND PROTECTIVE AGENTS.

Emollients are substances which soften, relax, and protect the tissues to which they are applied They relieve pain and tension by diminishing heat and lessening the pressure on the nerves.

The principal emollients are—

Glycerin,
Soap Liniment,
Starch,

Fats and Oils, ...	Lard, Olive Oil, Almond Oil, Spermaceti, Linseed Oil, Cacao Butter, Petroleum, Paraffin, Petrolatum, Vaseline, etc.

Hot Fomentations,

Poultices, ...	Linseed Meal, Oatmeal, Bran, Bread, Flour, Figs, etc.

Demulcents are substances which soothe and protect the parts to which they are applied. They are generally of a mucilaginous nature, and are employed for their action upon mucous membranes, while emollients are principally used on the skin. The important demulcents are—

Acacia,	Marshmallow,	Sassafras-pith,
Barley,	Liquorice,	Isinglass,
Cetraria,	Starch,	Honey,
Almond,	Tragacanth,	Gelatin,
Flaxseed,	Glycerin,	Bland Oils.
Slippery Elm,	White of Egg,	

Both Emollients and Demulcents are exceedingly useful agents to relieve irritation of the skin in certain cutaneous diseases; by softening the skin and mucous membranes they also prevent cracking or chapping from exposure to cold. They are also efficient agents to prevent *bed-sores* and to lessen friction between approximating surfaces, as between the nates and about the groins of children.

Demulcents are employed internally with good results when there is an *irritated or inflamed condition of mucous membranes*, whether of the respiratory, gastro- intestinal or genito-urinary tracts, as in *bronchitis*, *gastritis*, *enteritis*, *diarrhea*, *dysentery*, *strangury*, *cystitis*, etc.

Demulcents—such as FLAXSEED, SLIPPERY ELM, MARSHMALLOW, or SASSAFRAS-PITH—are very agreeable and efficient agents to *quench thirst* and to relieve the irritation of mucous surfaces in *febrile affections*.

Protectives are agents used to mechanically cover and protect injured or diseased surfaces from extraneous influences, as from air, water, etc.

Certain agents classed as protectives are employed for their absorptive power of taking up by capillary attraction any moisture or fluid present.

They are useful agents as protective coatings to *bed-sores* or to *excoriated*, *abraded*, or *burned surfaces*.

The principal protectives are—

Collodion,
Solution of Gutta-percha,
Solution of Sodium Silicate,
Court-plaster (Emplastrum Ichthyocollæ),
Lycopodium,
Charcoal,
Animal Charcoal,
Purified Cotton.

The Emollients, Demulcents, and Protectives which are deemed sufficiently important to merit more consideration than has been given them elsewhere in the present work, will be now considered.

Glycerīnum—Glycerīni—Glycerin. *U. S. P.*

Origin.—A liquid obtained by the decomposition of vegetable or animal fats or fixed oils, and containing not less than 95 per cent. of absolute glycerin.

Description and Properties.—A clear, colorless liquid, of a thick, syrupy consistence, oily to the touch, odorless, very sweet and slightly warm to the taste. When exposed to the air, it slowly abstracts moisture. Specific gravity not less than 1.250. Soluble in all proportions in water or alcohol; also soluble in a mixture of 3 parts of alcohol and 1 part of ether, but insoluble in ether, chloroform, carbon disulphide, benzin, benzol, and fixed or volatile oils.

Dose.—5–60 minims (0.3–4.0 Cc.).

Official Preparations.

Glycerītum Ămyli—Glycerīti Ămyli—Glycerite of Starch.—Starch, 10; Water, 10; Glycerin, 80. Used internally or externally.

Glycerītum Vitĕlli—Glycerīti Vitĕlli—Glycerite of Yolk of Egg (GLYCONIN).—Fresh Yolk of Egg, 45; Glycerin, 55. Used freely internally or externally.

Suppositōria Glycerīni—Suppositōria (acc.) **Glycerīni—Suppositories of Glycerin.**—(Each suppository contains 93 grains (6.0 Gm.) of glycerin.) Used as required.

Glycerin is also contained in the following official preparations:

Glycerītum Ăcidi Carbŏlici, Glycerītum Ăcidi Tănnici, Glycerītum Boroglycerīni, Glycerītum Hydrăstis, Mucilāgo Tragacănthæ, Măssa Hydrărgyri Pĭlulæ Phŏsphori, and in many extracts and fluid extracts.

Antagonists and Incompatibles.—Glycerin is incompatible with potassium permanganate and with chromic acid.

Synergists.—Its emollient properties may be enhanced by emollients and demulcents.

Physiological Action.—*Externally and Locally.*—When glycerin is applied to the skin or mucous membrane it is ordinarily bland and unirritating, although in certain cases the drug occasions a sensation of burning and smarting, which may be due either to an impure preparation, the rapid absorption of water from the tissues, or merely to a marked idiosyncrasy on the part of the patient. Should the pure drug show a tendency to irritate the skin, the glycerin should be properly diluted with water.

Preparations more concentrated than the specific gravity recommended by the U. S. Pharmacopœia—viz. 1.25—should be avoided, because of their irritating properties.

Glycerin abstracts water from the tissues, and is rapidly absorbed through the skin. It possesses marked diffusive power, being capable of diffusing itself freely over and through organic matter.

Internally.—The principal action of glycerin when taken inter-

nally is that of a purgative. The drug purges when given by the rectum, either as enema or in the form of a suppository.

Glycerin is readily absorbed from the alimentary canal, and it is thought by some physicians to undergo oxidation, thereby acting as a food and increasing body-weight. Other competent investigators allege that it is not in the least degree nutritious.

When immoderate amounts of the drug are taken, it may be detected in the urine, while under excessive doses effects may be produced similar to those resulting from alcoholic poisoning.

Following the ingestion of very large doses, there may be extreme muscular weakness, dryness of mucous membranes, dark-colored urine, collapse, and death. The drug is not considered poisonous, excessive amounts being necessary to produce the symptoms above described.

Therapeutics.—*Externally and Locally.*—GLYCERIN is a popular and efficient remedy for *chapped hands* and slight *excoriations.*

Fissured nipples and *fissure of the anus* are well treated with pure GLYCERIN or with glycerin and tannic acid. The drug also makes an efficient application to *bed-sores.*

GLYCERIN is employed as an injection in *gonorrhea.* It may be used alone or medicated with bismuth subnitrate or with extract of opium.

GLYCERIN is one of the best solvents for hardened *cerumen,* and tampons wet with glycerin or with GLYCERITE OF TANNIC ACID are very serviceable in *leucorrhea* and *erosion of the cervix,* and *endometritis* with *congestion and subinvolution of the uterus.*

GLYCERIN possesses marked antipruritic properties, and, whether applied pure or combined with oils or ointments, will allay *itching* of most affections of the skin.

LOTIONS OR DILUTED AQUEOUS SOLUTIONS OF GLYCERIN are frequently employed in various diseases of the *ear, nose,* and *throat,* such as *fissure of the tongue, chronic laryngitis, chronic nasal catarrh, coryza, pharyngitis,* etc.

A mixture of GLYCERIN AND WATER will lessen or prevent *dryness of the mouth* from fever or other causes.

GLYCERIN is an efficient topical remedy for the reduction of *edema of the prepuce,* and is a serviceable antiseptic dressing for *wounds, carbuncles, boils,* etc.

GLYCERITE OF STARCH is an excellent soothing emollient in *ac*[illegible] and quite an efficient preparation to prevent pitting in

GLYCONIN (glycerite of yolk of egg) makes an agreeable, soothing application in *erysipelas, fissured nipples*, etc.

Internally.—The principal internal use for GLYCERIN is for the relief of *habitual constipation*, being far more efficient in habitual than in occasional constipation, and more generally applicable to females than to males, and to those cases where the fecal mass is retained in the rectum than in the sigmoid flexure or above it. For the purpose of relieving constipation it may be given by the mouth, alone or associated with castor oil, or 1 or 2 fluidrachms (4.0–8.0 Cc.) injected into the rectum, or, which perhaps is the most agreeable method, by the insertion into the rectum of a GLYCERIN SUPPOSITORY.

GLYCERIN is said to relieve the *acidity, pyrosis*, and *flatulence of dyspepsia*.

It has been employed in *diabetes*, but without favorable results.

Administration.—Whether glycerin be used externally or internally, it should always be chemically pure, otherwise much irritation may be produced.

For external use it may be used pure or mixed with water, or in various lotions, ointments, etc.

Internally it is seldom given alone, but with syrups, water, wine, or other alcoholic liquors.

Ōleum Olīvæ—Ōlei Olīvæ—Olive Oil. *U. S. P.*

Origin.—The fixed oil expressed from the fruit of *Olea Europæa* L., a shrubby, thorny, medium-sized tree, indigenous in Western Asia, but cultivated in the countries bordering on the Mediterranean and in the Southern United States, California, and several South American and other countries.

Description and Properties.—A pale yellow or light greenish-yellow, oily liquid, having a slight, peculiar odor, and a nutty, oleaginous taste, with a faintly acrid after-taste. Very sparingly soluble in alcohol, but readily soluble in ether, chloroform, or carbon disulphide. Olive oil should be kept in well-stoppered bottles in a cool place.

Dose.—Freely.

Physiological Action and Therapeutics.—OLIVE OIL is a singularly bland and agreeable oil, and very useful as an emollient and demulcent. It serves as an efficient protective to the skin, from which it is readily absorbed. As a lenitive and protective in cases

of superficial *wounds*, *bruises*, *excoriations*, *burns*, *bites* and *stings of insects*, *sprains*, etc. it serves a valuable purpose.

It is extensively employed by dermatologists to soften and facilitate the removal of *crusts*, *scales*, and *epithelial débris* of various *cutaneous disorders*.

The application of warm olive oil, made with gentle friction to *painful* and *engorged mammary glands* during pregnancy and after parturition, generally lessens the pain and swelling.

The drug is an efficient palliative in *painful deglutition*, and is sometimes injected into the rectum as a soothing emollient in *dysentery*, and to destroy "*seat-worms*" and allay the irritation produced by them.

Frequently the forcible injection into the urethra of olive oil will dilate an unusually tight *stricture*, partly overcoming the difficulty to the introduction of a sound.

Olive oil is habitually employed as a lubricant for sounds, catheters, specula, pessaries, etc.

Where a fat or an oil is not contraindicated, olive oil is one of the most efficient demulcents to administer in cases of *poisoning from corrosive irritating drugs*.

Olive oil is a useful and pleasant laxative, and is used to a considerable extent for that purpose. The oil is also credited with facilitating the discharge of *gall-stones*. It unquestionably increases the secretion of bile, which may account for its apparent influence in favoring the expulsion of these concretions.

Ōleum Amўgdalæ Exprĕssum—Ōlei Amўgdalæ Exprĕssi—Expressed Oil of Almond. *U. S. P.*

Origin.—A fixed oil expressed from Bitter or Sweet Almond (*Prunus Amygdalus*, var. *amara* and *dulcis*, De Candolle), a tree 15 to 20 feet (5 to 6 M.) high, indigenous in Western Asia and cultivated in subtropical countries.

Description and Properties.—A clear, pale straw-colored or colorless, oily liquid, almost inodorous, and having a mild, nutty taste. Only slightly soluble in alcohol; soluble in ether, and in chloroform in all proportions. It should be kept in well-stoppered bottles, in a cool place.

Dose.—1–4 fluidrachms (4.0–8.0 Cc.).

Expressed Oil of Almond is contained in Unguentum *Aquæ*

R

ical Action and Therapeutics.—The expressed oil

of almond is a peculiarly bland and agreeably efficient demulcent and emollient, being used both externally and internally for the same purposes as olive oil.

Ōleum Līni—Ōlei Līni—Linseed Oil. *U. S. P.*

(Oil of Flaxseed.)

Origin.—A fixed oil expressed without heat from the seed of *Linum Usitatissimum* L.

Description and Properties.—A yellowish or yellow, oily liquid, having a slight, peculiar odor, and a bland taste. When exposed to the air it gradually thickens and acquires a strong odor and taste; and if spread in a thin layer on a glass plate, and allowed to stand in a warm place, it is gradually converted into a hard, transparent, resin-like mass. Soluble in about 10 parts of absolute alcohol, and, in all proportions, in ether, chloroform, benzin, carbon disulphide, or oil of turpentine. Linseed oil should be kept in well-stoppered bottles.

Dose.—½–2 fluidounces (15.0–60.0 Cc.).

Physiological Action and Therapeutics.—The action and uses of flaxseed oil are similar to those of olive oil. One of its most important uses, when mixed with an equal quantity of lime water, is in the treatment of *burns*.

The linseed itself is used extensively as a domestic demulcent in the form of a tea, for *cough*, etc., while the ground linseed makes an excellent poultice for all *deep-seated inflammations*.

Acăcia—Acăciæ—Acacia. *U. S. P.*

(Gum Arabic.)

Origin.—A gummy exudation from *Acacia Senegal* Willdenow, a small tree about 20 feet (6 M.) high, found in India and Africa, especially in the district of Khartoum, westward to Senegambia.

Description and Properties.—In roundish tears of various sizes, or broken into angular fragments, with a glass-like, sometimes iridescent fracture, opaque from numerous fissures, but transparent and nearly colorless in thin pieces; nearly inodorous, taste insipid, mucilaginous; insoluble in alcohol, but soluble in water, forming a thick mucilaginous liquid. Acacia should be slowly but completely soluble in 2 parts of water.

Official Preparations.

Mucilāgo Acăciæ—Mucilāginis Acăciæ—Mucilage of Acacia (34 per cent.). —*Dose*, freely.

Sȳrupus Acăciæ—Sȳrupi Acăciæ—Syrup of Acacia.—*Dose*, freely.

Acacia is contained in **Emulsum Amygdalæ, Pulvis Cretæ Compositus,** and in some trochisci.

Physiological Action and Therapeutics.—Acacia is a valuable demulcent, and gum water is in ordinary use to serve as a protective to inflamed and irritated mucous membranes of the respiratory, alimentary, and genito-urinary tracts, as in cases of *pharyngitis, laryngitis, dysentery, gastritis, typhoid fever*, and in *febrile affections* generally. The mucilage of acacia is sometimes used as a protective for superficial *burns, excoriations*, etc.

Cetrāria—Cetrāriæ—Cetraria. *U. S. P.*

(Iceland Moss.)

Origin.—*Cetraria Islandica* L., fronds of a lichen indigenous in the Northern Hemisphere.

Description and Properties.—From 2 to 4 inches (5 to 10 Cm.) long, foliaceous, irregularly branched into fringed and channelled lobes, brownish above, whitish beneath, and marked with small, depressed spots; brittle and inodorous; when softened in water, cartilaginous, and having a slight odor; its taste is mucilaginous and bitter.

Official Preparation.

Decŏctum Cetrāriæ—Decŏcti Cetrāriæ—Decoction of Cetraria.

Physiological Action and Therapeutics.—Cetraria is a demulcent and tonic, and may be used for the same purposes as acacia. It is, however, more nutritious than acacia, and is used to a considerable extent for *chronic pulmonary affections.*

Ŭlmus—Ŭlmi—Elm. *U. S. P.*

(Slippery Elm.)

Origin.—The inner bark of *Ulmus fulva* Michaux, a medium-sized tree, from 30 to 60 feet (9 to 18 M.) high, found in the United States and Canada.

Description and Properties.—In flat pieces, varying in length and width, about $\frac{1}{8}$ inch (3 Mm.) thick, tough, pale brownish-white, the inner surface finely ridged; fracture fibrous and mealy; the [illegible]verse section delicately checkered; odor slight, peculiar; taste [illegible]ginous, insipid.

Official Preparation.

Mucilăgo Ŭlmi—Mucilăginis Ŭlmi—Mucilage of Elm.—*Dose*, freely.

Physiological Action and Therapeutics.—Elm is a decided demulcent and possesses nutritive properties. It is pleasant to the taste and does not readily disturb the stomach. It is principally used as a demulcent in diseases of the gastro-intestinal and genito-urinary tracts, as *diarrhea*, *dysentery*, *cystitis*, *urethritis*, etc. The fibrous bark is moulded into tents used to dilate the neck of the *uterus*, *fistulous openings*, etc.

Althæa—Althææ—Althæa. *U. S. P.*

(MARSHMALLOW.)

Origin.—The root of *Althæa officinalis* L., a perennial herb indigenous in the temperate portion of Northern and Western Asia and in the greater part of Europe.

Description and Properties.—In cylindrical or somewhat conical pieces, from 4 to 6 inches (10 to 15 Cm.) long, about ½ inch (12.7 Mm.) thick, deeply wrinkled, deprived of the brown corky layer and small roots; externally white, marked with a number of circular spots, and of a somewhat hairy appearance from the loosened bast-fibres; internally whitish and fleshy. It breaks with a short, granular, and mealy fracture, and has a faint, aromatic odor and a sweetish, mucilaginous taste. It contains *asparagin*, mucilage, sugar, and pectin.

Official Preparation.

Sўrupus Althææ—Sўrupi Althææ.—Syrup of Althæa.—*Dose*, freely.

Physiological Action and Therapeutics.—Marshmallow is emollient, demulcent, and protective, and is an efficient protective and emollient in *irritable and inflamed conditions of the skin*, and a highly efficacious demulcent in all inflammatory and irritable conditions of the *respiratory*, *digestive*, and *urinary organs*.

Tragacăntha—Tragacănthæ—Tragacanth. *U. S. P.*

Origin.—A gummy exudation from *Astragalus gummifer* Labillardière, and from other species of *Astragalus*, low shrubs, indigenous in a portion of the territory lying between Eastern Persia and Greece.

Description and Properties.—In narrow or broad bands, more or less curved or contorted, marked by parallel lines or ridges, white or faintly yellowish, translucent, horn-like, and tough. It

contains 33 per cent. of a gum, *bassorin*, which is only slightly soluble in water.

Official Preparation.

Mucilāgo Tragacānthæ—Mucilāginis Tragacānthæ—Mucilage of Tragacanth.—*Dose*, freely.

Physiological Action and Therapeutics.—Tragacanth is demulcent and nutritious, and may be used for the same purposes as acacia, Iceland moss, etc. The mucilage of tragacanth is singularly efficacious as a soothing emollient in *chapped hands* and irritable conditions of the skin.

Săssafras Medŭlla—Săssafras Medŭllæ—Sassafras Pith. *U. S. P.*

Origin.—The pith of *Sassafras variifolium* (Salisbury) O. Kuntze, a tree indigenous in North America.

Description and Properties.—In slender, cylindrical pieces, often curved or coiled, light, spongy, white, inodorous, and insipid. Macerated in water, it forms a mucilaginous liquid, which is not precipitated by the addition of alcohol.

Official Preparation.

Mucilāgo Săssafras Medŭllæ—Mucilāginis Săssafras Medŭllæ—Mucilage of Sassafras Pith.—*Dose*, freely.

Physiological Action and Therapeutics.—Mucilage of Sassafras Pith is an agreeable demulcent and a mild local stimulant, and may be used for the same purposes as slippery elm, tragacanth, acacia, etc. It forms a pleasant vehicle for more active remedies.

Ichthyocŏlla—Ichthyocŏllæ—Isinglass. *U. S. P.*

Origin.—The swimming-bladder of *Acipenser Huso* L. and of other species of *Acipenser*.

Description and Properties.—In separate sheets, sometimes rolled, of a horny or pearly appearance; whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; almost entirely soluble in boiling water and in boiling alcohol. A solution of isinglass in 24 parts of boiling water forms, on cooling, a transparent jelly.

Dose.—Freely.

Official Preparation.

Emplăstrum Ichthyocŏllæ—Emplăstri Ichthyocŏllæ—Isinglass Plaster— (COURT PLASTER).

Physiological Action and Therapeutics.—Isinglass is emollient, demulcent, and protective, and possesses nutritive properties. Isinglass plaster is commonly employed to protect *abraded surfaces* and slight *cuts of the skin.* It should be moistened with pure water and never with saliva.

Lycopōdium—Lycopōdii—Lycopodium. *U. S. P.*

Origin.—The spores of *Lycopodium clavatum* L. and of other species of Lycopodium, low-creeping perennials found in dry woods distributed over the greater portion of the globe.

Description and Properties.—A fine powder, pale yellowish, very mobile, inodorous, tasteless, floating upon water and not wetted by it, but sinking on being boiled with it, and burning quickly when thrown into a flame. Under the microscope the spores are seen to be sphæro-tetrahedral, the surfaces marked with reticulated ridges, and the edges beset with short projections. Lycopodium contains a fixed oil and a minute quantity of a volatile base, methylamine. Used principally externally.

Physiological Action and Therapeutics.—Lycopodium is an admirable protective, and possesses great power of absorbing oils. Its lightness, dryness, and absorptive power render it an excellent dusting powder for excoriated surfaces, *eczema*, *herpes*, *intertrigo erysipelas*, superficial *ulcers*, etc.

Its peculiar property of not being wetted with water makes it a valuable protective to prevent *irritation* or *chafing* caused by the urine or alvine dejections of infants.

The drug is used as a basis for insufflations and in pharmacy to prevent the adhesion of pills.

PRESCRIPTIONS.

A PRESCRIPTION (L. *præ*, for; *scribo*, I write) is an order on the pharmacist to compound for the patient certain medicines intended to meet the requirements of the individual case. Considering it as an order, therefore, it should begin with the Name of the person for whom it is designed and the Date on which it is written. In some cases it may be advisable to omit the *name*, but the *date* should never be omitted.

The date is often indicated by the calendar number, instead of the name of the month, thus: 3. | March, 3d month | 10. | day of the month | '99. | year | . Unfortunately, there is no uniform usage in this respect, some persons writing the number and others the day of the month first, so that a druggist unfamiliar with the custom of the physician could not know whether 3. 10. '99. meant March 10th or October 3d of the year. The Latin numerals are also employed to designate the month: III. 10. '99. To avoid all chance of error, it is best to abbreviate the month or write it in full: March 10, 1899. The importance of the date is manifest from its value to the physician or pharmacist as a reference, and the possibility of its evidence being required in medico-legal contingencies.

After the name and date comes the prescription proper, the name of the article required or the ingredients in case of a mixture. In the latter instance the various ingredients are written in a certain order or sequence with reference to their medicinal action or importance, which usually is also in accord with their pharmaceutical requirements for satisfactory dispensing.

For the purpose of examination a regular prescription may be divided into six parts:

1. The name of the patient and the date of the order;
2. The *superscription*, or heading, indicated by the symbol ℞, standing for the Latin word *Recipe*, "take;"
3. The *inscription*, expressing the names and quantities of the ingredients;
4. The *subscription*, being instructions to the pharmacist or compounder;
5. The *signature*, containing directions to the patient or attendant;
6. The Name of the Physician.

Example:

For Mrs. B——. July 3, 1899.

℞.[1] Olei morrhuæ, f℥iij;
Vini albi, f℥j; [2]
Glyceriti vitelli, q. s. ad f℥viij.
Fiat emulsio.[3]
Sig. Tablespoonful after meals.[4]

Dr. P——.

Here the small numeral or exponent, [1], is the *superscription;* [2], the *inscription;* [3], the *subscription;* [4], the *signature.*

A typical prescription consists of a formula of four divisions:

The *Basis,* or principal active agent;

The *Adjuvant,* or auxiliary, to aid the action of the Basis;

The *Corrective,* to correct or modify its action;

The *Vehicle,* to give proper form or taste to the whole.

Each ingredient should have a separate line, although it is not necessary that all prescriptions should include the above complete formula.

Combination of Drugs.

In writing a prescription we assume that it is intended, as should always be the case, to fulfil a single therapeutic purpose only; and we are to decide first, whether the medicine shall be administered in a solid or in a liquid form; and second, whether a single medicine shall be prescribed or a combination of remedies.

The drug upon which we base our expectations of success, the Basis of the inscription, should always be written first, and this drug may be the only one required. Frequently, however, some other drug is necessary to assist the action of the Basis, which substance would be the Adjuvant (Lat. *adjuvare,* to assist). No general rule can be laid down in this matter. The course to pursue will depend entirely upon the therapeutic indication, the physiological action of the drug, and the idiosyncrasies of the patient. The tendency to-day, among many able therapeutists and clinicians, is to prescribe single drugs or simple combinations, while the prescriptions of former times are good examples of polypharmacy. There is, at all events, danger in going to the extreme of sacrificing therapeutic efficiency to simplicity of form and elegant pharmacy;

[1] In ancient times it was customary to preface a prescription with a pious invocation to Jupiter or some guardian deity. These prayers were finally abbreviated, until they came to be expressed by the simple astronomical sign ♃, symbol of the planet Jupiter. The upright stroke across the letter R heading modern prescriptions is a curious relic of the above heathen usage condensed in the planetary sign.

and it must be confessed that such compounds as Warburg's tincture and the bolus prescribed by Dr. Graves in the treatment of dropsical patients prove the efficacy of polypharmacy in many cases.

Curare	Base	To cure
Cito	Adjuvant	Quickly
Tuto	Corrective	Safely
Et jucunde	Vehicle, Excipient, or Diluent	And pleasantly.

The hackneyed rule of Asclepiades that medicines should always be so combined as to cure quickly, safely, and pleasantly (curare, cito, tuto, et jucunde) has resulted in the adoption of the above form of inscription.

The theoretical prescriber writes by rule, religiously avoids incompatibles, and would be shocked by, and have little respect for, a physician who should deliberately include in the same prescription the names of substances directly antagonistic to each other physiologically. The subject will be further discussed hereafter.

As a general rule, we prescribe only one drug to provoke emesis, and a combination of several if we wish a diuretic. A purgative is usually multiple, but if the selection be castor oil or croton oil, it will be single.

After we have selected the Basis, or chief ingredient, of our prescription, the next point to determine is whether we can add anything which will in any manner be of real assistance to that Basis. This ingredient, or Adjuvant, as it is called—has usually a physiological action similar to that produced by combining two cathartics or two diuretics acting upon different portions of the intestines or kidneys. Sometimes, however, an Adjuvant may differ in its effects—as sulphuric acid serves as an Adjuvant to quinine, by favoring its absorption and thereby hastening and increasing its action, as mercury assists the action of squills upon the kidneys, or iron acts as an Adjuvant to a cardiac stimulant.

The Adjuvant, as a rule, should not be directly opposed in its action to that of the Basis, as chloral is to strychnine, a diuretic to a diaphoretic, or a typical cardiac stimulant to a cardiac depressant.

Having chosen the Adjuvant, the next point to consider is whether the action of the drugs selected may not be rendered more kindly through the addition of some other substance as a

corrective. A substance may be added which will correct some disagreeable effect of the active agents by producing a medicinal impression upon the patient. Extract of belladonna or hyoscyamus relieves the griping occasioned by some of the more violent cathartics, like podophyllin, and other well-known instances of this kind are those of the aromatic spirit of ammonia, which mitigates the unpleasant symptoms of iodism, and hydrobromic acid, which lessens the untoward action of quinine.

Again, a corrective may act by producing some chemical effect upon the Basis—as salicylic acid is rendered more soluble and less irritating by combining it with sodium carbonate or bicarbonate, forming the sodium salicylate.

Great care and thought should be given not only to the Basis, Adjuvant, and Corrective, but also to the Vehicle, which claims equal attention. A prescription is often rendered more kindly, and no less efficient, through the medium of some substance producing a more agreeable taste. It is a mistaken idea that medicines, in order to be effective, should be repulsive to the patient. The homeopath's success is largely due to the very agreeable taste of his remedies. The mere caprice of the patient, however, should not be considered in the choice of a remedy when, in the best judgment of the physician, it is indicated. Still, it is well to study carefully the art of prescribing agreeable doses, so far as may be compatible with fidelity to science. It is to be noted that pleasantness of taste is far more important in the case of fluids than in that of solids.

Aromatic elixirs, syrups, aromatic waters, etc. are in frequent use as Vehicles, yet it must be remembered that oftentimes a sensitive patient repudiates sweets and syrupy mixtures. In many cases simple syrup or pure water serves, after all, as the best vehicle, although the physician's choice must be governed mainly by experience.

It will be observed that in the body of the present work, in the majority of cases, the method of administration is fully explained. It may here be noted that liquids are much more readily absorbed than solids, yet adults usually prefer to take medicines in the solid form, such as pills, capsules, powders, and tablets. In illness the patient's condition is often such that the gastric and intestinal secretions are greatly reduced, and there may not be sufficient fluid to dissolve the solid, so as to render it in a condition to be absorbed. It frequently happens, for instance, that pills are voided with the

stools unchanged, and, on the other hand, solid substances, such as pills or capsules, may remain in the intestinal canal until the secretions are restored, when the accumulated medicine will all be acted on at once, and, passing into solution, be absorbed in excessive doses. Such is the frequent cause of the *cumulative* effect which sometimes occurs, not without serious consequences.

Even alkaloidal salts, which are readily soluble, are, perhaps, in many instances, best given in solution.

Infants require liquid medicines, water or syrup being the best vehicle. Bitter medicines, like quinine, may be given in aromatic elixir of liquorice or syrup of yerba santa. As a general rule the metals and their compounds should be administered in the form of pills or in a small quantity of fluid. The purgative salts, potassium iodide, and the diuretics, are best given in large quantities of fluid.

Prof. H. C. Wood, M. D., has written so clearly upon the art of combining, or, more correctly speaking, associating, medicines that we cannot do better than quote his observations *verbatim:*

"The art of combining medicines is not a difficult one, but in practice certain principles should not be lost sight of. Chief of these are, to prescribe as few remedies as possible, and to use no powerful drug without a very distinct idea of what it is intended to do. Whenever it is desired to give a powerful remedy in increasing doses until its physiological effect is produced, it should always be given by itself. Thus, it may be necessary to give arsenic so as to impress the system, at the same time that iron is indicated; but the two remedies should be given separately, so that the dose of either can be increased or diminished independently of the other."

The principles of combination formulated below were long ago enunciated by Dr. Paris, but are to-day as imperative as ever. Medicines are combined—

"*First.* To augment, correct, or modify the action of a medicine. Thus, purgatives act much more kindly when a number of them are united together. The chief reason of this probably is that, as different remedies affect different portions of the gut, the whole intestine is best reached by a union of the diverse substances. It may take an intense irritation of the mucous membrane to purge as actively as does a mild irritation of both the mucous membrane and the muscular coat.

"There are powerful medicines which act similarly upon some parts of the organism, but dissimilarly upon other parts. By com-

bining such remedies powerful effects can be obtained at the points where the two lines of action cross each other, without influencing to a great extent other portions of the system. Thus, chloral produces sleep by its action upon the brain, and also has a distinct influence upon the heart, but none upon the intestinal tract. Morphine acts upon the brain, and does not influence the heart, but has a powerful effect upon the intestinal tract. By combining chloral and morphine we get an overwhelming conjoined influence upon the brain in producing sleep, with the least possible disturbance of the heart and of the intestinal tract.

"*Second.* To obtain the joint action of two or more diverse remedies. Thus, in a cough-mixture morphine may be included to quiet the cough, whilst ipecacuanha and squill (in accordance with the first principle) are added to affect the mucous membrane. The application of this principle requires caution, or the practitioner will be led into that chief abomination—polypharmacy. It is worse than futile to attempt to prescribe for every symptom. It is the underlying cause of the disorder, or the under-stratum of bodily condition, which must be sought out and prescribed for simply.

"*Third.* To obtain a special combination which is really a new remedy, or which experience has shown acts almost as a new remedy. Thus, when to potassium iodide in solution corrosive sublimate is added a new chemical compound (potassio-mercuric iodide) is formed, which experience has shown to be of great value in syphilitic diseases. Griffith's antihectic mixture (mistura ferri comp.) is another instance of the use of chemical changes, the protocarbonate of iron (ferrous carbonate) being formed out of the sulphate of the metal and the potassium carbonate. In the famous Dover's powder no chemical change occurs, but the ordinary action of opium upon the skin is so enhanced by the ipecac that the combination may be looked upon almost as a new remedy.

"*Fourth.* To afford a suitable form. Thus, acacia is added to make an emulsion, or confection of rose to make a pill. In the choice of excipients care should be exercised to select a substance free from medicinal properties, having no chemical incompatibility with the medicinal agent and of suitable physical character. Bread-crumb often makes a good excipient for pills, but with silver nitrate it is chemically incompatible, on account of the sodium chloride it contains.

"When writing a prescription the utmost care should be taken to use such excipients that the combination should not only be

attractive to the eye, but also as little repulsive to the palate as may be. Whenever possible the pill form should be employed with bitter or disagreeable medicines. The pill may be readily coated with silver-foil; tonic pills may be coated with iron by shaking or rolling them in ferri pulvis while soft and sticky. Sugar-coated pills and 'compressed pills' are apt to get so hard and insoluble that their use requires caution. In regard to mixtures, flavoring oils should be freely used, and the power of glycerin to conceal the disagreeable taste of many substances should be remembered."[1]

As vehicles for liquid mixtures for internal use the following classes of official preparations are best adapted—The aromatic waters: rose, anise, fennel, and the mints when flavor alone is desired, the most delightful flavor of all being orange flower water. The aromatic syrups: orange, orange flower, and tolu when it is desired to disguise the taste and to suspend resinous or otherwise sparingly soluble substances in the mixture. The elixirs when in addition to agreeable flavor it is desirable to employ a vehicle as a solvent for certain salts not readily soluble in water or syrups. The elixirs containing about 25 per cent. of alcohol, they are useful vehicles for tinctures and fluid extracts of resinous drugs such as cubeb, buchu, uva ursi, valerian, viburnum, etc.

When flavor alone is desired the elixir aromaticum, U. S. Ph., a delightful combination of orange and other aromatics, should be used. To disguise the taste of bitter drugs, as in the last mentioned, elixirs of licorice, or of eriodictyon (yerba santa) are mostly employed.

Incompatibility.

Due regard is to be paid to the mutual chemical, pharmaceutical, and therapeutical relations of the drugs combined in a prescription.

When different substances, whether liquid or solid, are combined or associated and undergo a more or less complete change, they are said to be incompatible, the incompatibility consisting of three kinds: chemical, pharmaceutical, and therapeutical, although the last division is not scientifically correct, since one substance cannot be therapeutically *incompatible* with another, although it may be a physiological *antagonist*.

The incompatibles and antagonists of the different substances are usually mentioned under the respective drugs. The principles of incompatibility, however, may well be considered here.

[1] *Therapeutics*, 7th edition, pp. 108 et seq.

Chemical incompatibility is of the most importance.

The commonest forms of chemical incompatibility occur under the following conditions:

1. When a new and insoluble salt is formed, resulting from a mixture of solutions of soluble salts. Example (1): mixing solutions of lead acetate and zinc sulphate, both soluble salts, but producing by chemical decomposition a new and insoluble salt, the sulphate of lead, which is precipitated.

2. By the addition of a strong acid to solutions of salts of weak or volatile acids, such as carbonates and bicarbonates, with resulting decomposition. Example (2): ammonium carbonate, the salt of a weak acid radical, added to syrup of squills, containing acetic acid, causes decomposition to take place, with effervescence and the liberation of carbonic acid gas.

3. Salts of a feeble or volatile base are decomposed by the addition of a strong alkali. Example (3): the evolution of ammonia when a strong alkali is added to ammonia alum, and when chloral hydrate is decomposed by alkalies, such as aromatic spirit of ammonia, lime solution, etc.

4. Alkaloids, or their salts, are thrown out of solution or precipitated from their solutions by the addition of alkalies or alkaline salts. Example (4): sulphate of strychnine in solution is precipitated as the insoluble bromide of strychnine by the addition of a larger proportion of potassium bromide. Quinine sulphate is precipitated as insoluble quinine acetate when mixed with a solution of potassium acetate.

5. Tannic and gallic acids and preparations containing them, as well as many other vegetable acids, produce discoloration or precipitation of iron and many of its compounds. Example (5): ink is the best illustration of this incompatibility. Writing fluids are usually combinations of tannic or gallic acid with some preparation of iron. Add the tincture of ferric chloride to tincture of cinchona, and notice the discoloration.

There are certain preparations of iron, like the compounds with ammonium or sodium citrate (see tinct. ferri citro-chloride, N. F., tasteless tincture of iron) which produce little discoloration with vegetable astringents, and none at all with vegetable preparations containing no tannic or gallic acid.

Pharmaceutical incompatibility is the production of fewer or more insoluble substances in mixtures or preparations of vegetable drugs, associated or not with any chemical compounds. Pharma-

ceutical incompatibility may occur in liquids or solids, although much more frequent in liquid mixtures, causing a separation of either inert or active ingredients. Examples: vegetable tinctures of resinous drugs with water, such as tincture of guaiac and water; copaiba and oils with aqueous preparations; spirit of nitrous ether with mucilage of acacia, etc. The separation or precipitation may frequently be prevented by the intervention of some viscid substance, such as syrup, glucose, glycerin, mucilage of acacia, etc.

Incompatibility may be both chemical and pharmaceutical. In the following list the substances which cannot be classed as incompatible under any of the above divisions are given for reference:

SUBSTANCE.	INCOMPATIBLE WITH
Acacia	Alcohol, alcoholic and ethereal tinctures;* borax; ferric chloride; lead salts.
Acids in general	Alkalies, alkaline solutions; metallic oxides.
Acid. Arsenous.	Ferric hydrate; magnesia; lime water.
Salicylic	Iron compounds; potassium iodide;* lime water.
Tannic	Alkalies, carbonates and bicarbonates; lime water; chlorine water; albumin; gelatin.
Bismuth. Subnitrate	Calomel;* sulphur; tannin.
Chloral. Hydrate	Alkalies, carbonates;* ammonium and mercury compounds; potassium bromide and alcohol.
Iodine	Ammonia;* alkalies, carbonates; chloral; metallic salts; starch.*
Lead. Acetate	Acacia; acid hydrochlor.; acid sulphuric and sulphates; ammon. chloride; carbonates; lime water, iodine; potassium iodide; tannin.
Mercury. Bichloride	Potassium iodide;* salts, carbonates; tannin; borax.
Mild chloride (Calomel)	Acids, acid salts; alkalies, carbonates; ammon. chloride; iodine; potassium iodide; ferric chloride, iodide; sulphur.
Potassium. Chlorate	Acids, mineral; calomel; organic substances; sulphur.
Iodide	Acids, acid salts; alkaloids; iron; lead and mercury salts; potassium chlorate; silver nitrate; chlorine water.
Permanganate	Ammonia, salts; alcohol; glycerin; ethereal oils; organic substances.
Sodium. Bicarbonate	Acids, acid salts; acid, tannic; alkaloids; metallic salts.
Bromide	Acids, mineral; chlorine water; mercury compounds.
Silver. Nitrate	Acids, acetic, hydrochloric, hydrocyanic, sulphuric, tartaric, and their salts; alkalies, carbonates; iodine; potass. iodide, bromide; sulphur.

Those marked with an * are sometimes directed to be compounded for the purpose of effecting some special change or producing new compounds.

Among the above, potassium permanganate forms an explosive mixture with glycerin; so does chromic acid. Chlorates of potassium, etc. explode when triturated with sulphur. The strong acids, nitric and sulphuric acids, and especially mixtures of these, react so strongly with volatile oils (hydrocarbons) as to cause explosion. Iodine affects these oils in the same way—fulminates.

It not infrequently happens that the physician intentionally writes a chemically incompatible prescription. "Black wash" and "yellow wash" are examples. Other instances are such pharmacopœial preparations as liquor ammonii acetatis, mistura ferri composita, and liquor magnesii citratis.

Physiological antagonists are often given together, as atropine and morphine, or aconite and digitalis in certain cases of cardiac arrhythmia.

No general rule can be laid down for the avoidance of so-called therapeutical incompatibility. Some of our most valuable drugs contain active principles which are physiologically opposed to each other in their action; instance: jaborandi, which contains two absolutely antagonistic alkaloids, pilocarpine and jaborine, the latter in small quantity, yet sufficient to control the action of the former. Digitalis contains several distinct principles, one of which, digitonin, is the direct antagonist of the others.

Opium is a conspicuous example of a complex remedy, containing, besides gum, sugar, etc., eighteen different alkaloids, two neutral principles, and two peculiar acids; so that a prescriber of this drug, while he may, perhaps, flatter himself that he is conforming strictly to the present notions of pharmaceutical simplicity, is in effect a polypharmacist of most pronounced type. Moreover, not only are the constituents of opium very numerous, but, like others mentioned, the drug affords in its thebaïne and morphine a further illustration of direct physiological antagonism.

The author cannot too strongly recommend that physicians ignorant of the physiological action of drugs in large and small doses, if they prescribe at all, should avoid including many remedies in one prescription. Such practitioners had best adhere to a single remedy or adopt homeopathy. But, given a competent and thorough knowledge of the action of drugs and the exact condition of the patient, the physician is justified in giving one or twenty drugs in the same prescription, since he is perfectly familiar with the several agents of relief, and can foretell with nicety the effect to be produced by their combination; and in all cases a physician

should be as certain of the action, strength, and reliability of the drugs he administers as the surgeon of the aseptic condition of his hands and instruments.

Estimation of Amounts in a Prescription.

Having decided upon the various ingredients which are to enter into the prescription, the next consideration is the amount of each desirable.

In the first place, do not prescribe more than the prognosis seems to call for. If in your judgment the patient will not require medicine more than five or six days, and not oftener than three times a day, a two-ounce mixture should be prescribed if a liquid, or the required number of pills, powder, capsules, etc. if a solid, is desired.

In prescribing liquid medicines note must be taken of the several sizes of medicine-vials, their capacities being in this country 1, 2, and 4 fluidrachms, and 1, 2, 3, 4, 6, 8, 12, and 16 fluid-ounces. In the larger cities vials may also be had of metric capacities—30, 60, 90, 120, 240, and 500 Cc. While it is not essential, it is in much better taste to have a prescribed mixture aggregate just a bottleful of one of the above sizes. Where two different mixtures for the same person are prescribed, or different mixtures for different persons in the same house or family, it is well to order them put up in vials of different sizes to avoid confusing the medicine. This is especially desirable when both internal and external remedies are prescribed for the same person.

The amounts of the ingredients requisite for any given prescription are determined in various ways. The amount of the active ingredients will of course be the product of two factors, the quantity of dose and the number of doses required; and the quantities must be such as can be expressed in the system of weights and measures adopted, and indicated by round numbers such as best conform to the relation between the denominations of the particular system followed in the prescription.

There is no difficulty in computing the amounts in a *solid* mixture, powders, pills, or suppositories, especially if ten or its multiple is prescribed, nor in external preparations, where the strength is expressed by percentage, and are therefore most conveniently and accurately prescribed according to the metric system; but many additional considerations occur in estimating amounts in fluid mixtures.

Frequently solids like salts, etc. are prescribed in solution, but their bulk may be safely disregarded in the estimation of amounts of the liquid measure; for a solid in the quantity usually prescribed increases the whole volume of the solution but very little. Ordinarily a fluidrachm (4.0 Cc.), or a teaspoonful, should not contain over 5 grains (0.32 Gm.), nor a tablespoonful, or 4 fluidrachms (15.0 Cc.), over 20 grains (1.29 Gm.), of a solid in solution, unless the substance be very bland, when twice these quantities are permissible.

The following is a very simple rule for estimating amounts in Apothecaries' Measure:

In an *eight-ounce* mixture, the dose being a *drachm*, take as many *drachms* of the medicine as there are wanted minims or grains to the dose. It will be observed that in this case the basis is an *eight*-ounce mixture, yet it typifies the rule, which, when thoroughly understood, may easily be applied to a four-ounce or a two-ounce mixture, one-half or one-fourth as many drachms; while if the dose is to be a dessertspoonful, or two drachms, it is only necessary to take *one-half* as many drachms to an eight-ounce mixture, reducing for smaller mixtures in accordance with the rule. If the dose be a tablespoonful, or four *drachms*, *one-fourth* as many *drachms* must be taken to an eight-ounce mixture as there are minims or grains to the dose. This rule, while not fractionally exact, is sufficiently accurate for all practical purposes.

Examples: We desire to give an eight-ounce mixture, with a drachm for a dose, each dose to contain 12 grains of potassium bromide and 10 grains of chloral, the vehicle to be syrup of orange and water. We have here, then, 64 doses of a drachm each: to be exact, therefore, we should have 768 grains of potassium bromide, or 12 drachms and 48 grains; but, following the rule, we put in the mixture 12 drachms, since we desire 12 grains to the dose. Of chloral we would require exactly 640 grains, or 10 drachms and 40 grains, but we use the round number, 10 drachms, in the mixture. We see that in each case there is but the fraction of a grain short in the dose.

The prescription would consequently be written as follows:

℞. Potassii bromidi, ʒxij;
Chloralis, ʒx;
Syrupi aurantii, ℥iv;
Aquæ, q. s. ad ℥viij.
M. et ft. sol. Sig. Teaspoonful for a dose.

This is more of each ingredient than should be prescribed in a fluidrachm. It were better, then, that the dose should be a dessertspoonful, or two *drachms;* and in order that the two teaspoonfuls should contain only 12 grains of potassium bromide and 10 grains of chloral, the whole amount of the medicament must be divided by 2—*i. e.* the prescription should read:

℞. Potassii bromidi, ℥vj;
Chloralis, ℥v;
Syrupi aurantii, ℥iv;
Aquæ, q. s. ad ℥viij.
M. et ft. sol. Sig. A dessertspoonful for a dose.

In case the prescription be for a *four-ounce* mixture, with a dessertspoonful for a dose, the amounts of the solid substances would, of course, be one-half, and if for a *two-ounce* mixture, one-fourth of the above.

When writing a prescription put down first all the ingredients which are to enter into the combination, and after the last one, which is usually the vehicle, write the whole amount; *i. e.* if it is to be a four-ounce mixture, write after the name of the vehicle "q. s. ad f℥iv." Then begin with the Basis, the first ingredient, and write the amount required in the whole mixture. In other words, decide upon the doses to be given after the medicines have been selected.

It is important to adopt as a golden rule to carefully and deliberately read over the entire prescription before it is handed to the patient, and more especially to scrutinize each item and the quantities to guard against transposition of the latter, which otherwise may result in a fatal error.

The next thing to be determined is the manner in which the medicine should be measured out to the patient for internal use. A graduated medicine-glass is always preferable to a domestic measure, and should be ordered in all cases. Teaspoons, as well as dessertspoons and tablespoons, vary considerably, besides, owing to adhesion, may, according to the manner in which they are filled, show a variation of nearly 50 per cent. in their capacity. A teaspoonful, considered to be equivalent to one fluidrachm, may contain from one-half to two fluidrachms; a dessertspoonful, which should be equivalent to two fluidrachms, and a tablespoonful, equal to one-half fluidounce, vary almost as much in capacity.

It is necessary to be exact in the administration of medicines, it

Table exhibiting the amount of Drug required in Metric Measure based on 5 Cc. for each Dose, a metric spoonful; for 1 Dessertspoonful (10 Cc.) take one-half, for Tablespoonful (15 Cc.) take one-third the quantity.

Quantities required for each dose of 5 Cc.			Quantities of drug for subjoined measures in cubic centimeters, based on 5 Cc. for each dose.														
Gm.	Abbrev.	Equivalent. Grs.	10	15	30	50	60	75	90	100	120	150	180	200	240	480	500	1000
0.00065	mg 0.65	1/100	0.0013	0.002	0.004	0.0065	0.008	0.01	0.012	0.013	0.016	0.02	0.025	0.026	0.032	0.064	0.65	0.13
0.00085	" 0.85	1/75	0.0017	0.0025	0.005	0.0085	0.01	0.012	0.015	0.017	0.02	0.025	0.03	0.035	0.04	0.08	0.85	0.17
0.001	" 1.	1/60	0.002	0.003	0.006	0.01	0.012	0.015	0.018	0.02	0.024	0.03	0.04	0.04	0.045	0.09	0.1	0.2
0.0013	" 1.3	1/50	0.0025	0.0037	0.0075	0.013	0.015	0.02	0.025	0.025	0.03	0.04	0.045	0.05	0.06	0.12	0.13	0.25
0.0025	" 2.5	1/25	0.005	0.0075	0.015	0.025	0.03	0.037	0.045	0.05	0.06	0.075	0.09	0.1	0.72	0.24	0.25	0.5
0.0065	" 6.5	1/10	0.013	0.02	0.04	0.065	0.08	0.1	0.12	0.13	0.16	0.2	0.25	0.25	0.32	0.65	0.65	1.3
0.01	cg 1.	1/8	0.02	0.03	0.06	0.1	0.13	0.15	0.018	0.2	0.25	0.3	0.36	0.4	0.5	1.	1.	2.
0.013	c 1.3	1/6	0.025	0.037	0.075	0.13	0.15	0.2	0.25	0.25	0.3	0.4	0.5	0.5	0.6	1.2	1.3	2.6
0.016	" 1.6	1/4	0.032	0.05	0.1	0.16	0.2	0.25	0.3	0.32	0.4	0.5	0.6	0.65	0.8	1.6	1.6	3.2
0.032	" 3.2	1/2	0.065	0.1	0.2	0.32	0.4	0.5	0.6	0.65	0.8	1.	1.15	1.3	1.55	3.1	3.2	6.4
0.065	" 6.5	1	0.13	0.2	0.4	0.65	0.8	1.	1.2	1.3	1.6	2.	2.4	2.5	3.2	6.5	6.5	13.
0.1	dcg 1.	1½	0.2	0.3	0.6	1.	1.3	1.5	1.8	2.	2.5	3.	3.6	4.	5.	10.	10.	20.
0.13	" 1.3	2	0.25	0.37	0.75	1.3	1.5	1.9	2.3	2.5	3.	3.75	4.7	5.	8.	12.5	13.	26.
0.2	" 2.	3	0.4	0.6	1.2	2.	2.5	3.	3.6	4.	4.8	6.	7.2	8.	9.6	19.2	20.	40.
0.25	" 2.5	4	0.5	0.75	1.5	2.5	3.	3.4	4.5	5.	6.	7.5	9.	10.	12.	24.	25.	50.
0.3	" 3.	5	0.6	1.	2.	3.	4.	4.5	5.4	6.	7.2	9.	10.8	12.	14.5	29.	30.	60.
0.5	" 5.	7½	1.	1.5	3.	5.	6.	7.5	9.	10.	12.	15.	18.	20.	24.	48.	50.	100.
0.65	"65.	10	1.3	2.	4.	6.5	8.	10.	12.	13.	15.6	20.	23.4	25.	31.2	62.4	65.	130.
1.	Gm. 1.	15	2.	3.	6.	10.	13.	15.	18.	20.	24.	30.	36.	40.	48.	96.	100.	200.

being well known that the action of drugs varies greatly with the size of the dose, small doses in their action being often directly opposite to large doses.

Ordinarily, it is unwise to prescribe medicines to be dropped out, since a drop varies greatly in dimension according to the viscosity and specific gravity of the fluid, the shape, size, and character of the neck and lip of the bottle, as well as its degree of fulness, and the steadiness of the hand in dropping.

In computing doses of powerful medicines, therefore, always estimate for *minims* instead of drops.

Direct the use of a "dropper" or minim pipette for the administration of liquids by drop doses, such as Fowler's solution, collyria, etc. There are exactly *sixty minims* of any fluid to one fluidrachm, while sixty drops may be fewer or more than one drachm, as the following list shows:

	Drops in f℥j (60 M.).	Weight of f℥j. Gr.	Gm.
Acidum Carbolicum	111	59	3.82
Acidum Sulphuricum Aromaticum	146	53	3.43
Æther Fortior	176	39	2.52
Chloroformum Purificatum	250	80	5.18
Creosotum	122	56½	3.66
Ext. Belladonnæ Fluidum	156	57	3.69
Ext. Colchici Radicis Fluidum	160	55	3.56
Ext. Digitalis Fluidum	134	62	4.01
Liq. Iodi Compositus	63	59	3.82
Liq. Potassii Arsenitis	57	55	3.56
Oleum Caryophylli	130	57	3.69
Oleum Tiglii	104	50	3.24
Spiritus Ammoniæ Aromaticus	142	48	3.11
Syrupus Ferri Iodidi	65	77	4.98
Syrupus Scillæ Compositus	102	70	4.53
Tinctura Aconiti	146	46	2.98
Tinctura Belladonnæ	137	53	3.43
Tinctura Cantharidis	131	51	3.33
Tinctura Ferri Chloridi	150	53	3.43
Tinctura Nucis Vomicæ	140	44	2.85
Tinctura Opii	130	53	3.43
Tinctura Veratri Viridis	145	46	2.98
Vinum Colchici Seminis	111	54	3.49

Language and Grammatical Construction of Prescriptions.

A prescription is written partly in Latin, partly in English. The name of the patient and the date should be in English; the superscription in Latin abbreviations; the inscription in Latin; the sub-

scription in Latin or Latin abbreviations; and the signature, or directions to the patient, in English.

A prescription properly and unmistakably written is a cardinal requisite to the successful administration of medicine, no less than to its correct preparation by the druggist. Every practitioner and pharmacist should possess some knowledge of Latin grammar, yet by the observance of a few simple rules one wholly ignorant of the language may acquire a proper use of the forms generally adopted; and a little study, aided by constant practice, will soon fix in the memory the peculiarities of gender, case, and number, together with the agreement of adjectives, to be met with in all prescriptions.

It is to be observed that the Latin tongue has been chosen as the medium of medical and pharmaceutical instructions because of its conciseness, stability, and universal acceptance by the scientific world. Moreover, the Latin name is specific, while the English name may refer to several drugs of entirely different properties: for instance, "Snake root," applied by residents of this or that locality to *Cimicifuga racemosa*, *Aristolochia serpentaria*, *Asarum Canadense*, *Eupatorium aromaticum*, *Polygala Senega*, etc.

To begin with, then, the prescription-writer must endeavor to lay aside English and familiarize himself with various Latin verbs (most of them in the imperative, or *commanding*, mood); a long list of drugs and medicines, to be correctly written and pronounced; a limited number of adjectives, agreeing in gender, case, and number with the nouns they qualify; a few prepositions governing certain fixed cases; and a small number of terms and phrases of general importance. Let us consider them *seriatim*.

VERBS.

The first item of a prescription is a verb: *rĕcipe*, "take," the sign being ℞. One need not know the conjugation of the Latin *recipere* to understand the import of this order. Such imperatives simply signify the instructions of the physician.

A very few verbs are used in the subjunctive mood, having the force of the imperative, such as *fiat*, pl. *fiant*, "let it, or them, be made (into, *in pĭlulas*); or "let —— be made," as in the expression *fiat mistūra*, "let a mixture be made"; *sufficiat*, "may suffice," as in the common instruction, abbreviated "q. s.," *quāntum sufficiat*, "as much as may be required"; *ne repetātur*, "do not let it be repeated," or "do not repeat"; *bŭlliat*, "let it boil."

A future passive participle is also frequently used: *dividĕndus*, like an adjective agreeing with the noun in gender, case, and number, and signifying "to be divided (into)," as in the order *in trochīscos dividĕnda* (māssa), "to be divided into troches," though the imperative *divīde*, "divide into," is often used.

Nouns.

These form by far the largest vocabulary, including all official and nearly all unofficial drugs and medicines, together with their compounds. A considerable number, ending in *a*, are of the first declension, all feminine.[1] Example:

Singular.

Nominative.	— Olīva	—	Olive (subject).
Genitive.	— Olīvæ	—	of Olive.
Accusative.	— Olīvam	—	Olive (object).
Ablative.	— Olīvâ	—	with Olive.

Plural.

Nom.	— Olīvæ	—	Olives (subject).
Gen.	— Olivārum	—	of Olives.
Acc.	— Olīvas	—	Olives (object).
Abl.	— Olīvis	—	with Olives.

[The Latin dative and vocative cases are never used, and the plural number rarely.]

An extensive list of medical agents ends in *us* (generally masculine) or *um*, *on* (neuter), and are of the second declension. (Prīnos, masc., is exceptional.) Example:

Singular.

Nom.	— Ōleum	—	Oil (subject).
Gen.	— Ōlei	—	of Oil.
Acc.	— Ōleum	—	Oil (object).
Abl.	— Ōleo	—	with Oil.

Plural.

Nom.	— Ōlea	—	Oils (subject).
Gen.	— Oleōrum, Oleûm	—	of Oils.
Acc.	— Ōlea	—	Oils (object).
Abl.	— Ōleis	—	with Oils.

[1] The genders of nouns are given as a guide to the agreement of adjectives.

It may be noted, in passing, that the *genitive singular* is almost exclusively used in prescription-writing.

We are now prepared to analyze a simple prescription and understand its elements.

Referring to the foregoing examples, suppose we wish the druggist to supply three drachms of olive oil. We prescribe as follows:

℞.	Ōlei	Olīvæ	ʒiij.
Rēcipe, Take	of oil	of olives	three drachms.

It must be borne in mind that the direct object of the imperative *recipe* in this example, as well as in all similar cases, is not the medicine *ōleum*, but the *amount* of it prescribed, as indicated by the Roman numerals and the symbol of Apothecaries' weight, which, written in full, would be *trēs drăchmas* (acc.). In this class of prescriptions, therefore, including nearly all in use, we need consider only the genitive, the accusative or grammatical object of the verb being expressed in the *quantity* symbolically indicated.

It will be noted, moreover, that the construction, or order, of the Latin words is the reverse of English usage. Yet it is evident that a grocer's clerk, for instance, might well, and frequently does, employ the same mode of expression:

(of) Granulated Sugar ℔s 10—

a construction precisely analogous to that of the above prescription, which simple form may be taken as a type for all, subject to such modifications as the nature of the drug and the treatment may require.

Nouns of the second declension ending in *on*, all neuter, are of Greek derivation, and are declined like *ōleum*. Example:

Singular.

Nom. — Toxicodĕndron.
Gen. — Toxicodĕndri.
Acc. — Toxicodĕndron.
Abl. — Toxicodĕndro, etc.

Prīnos, also of Greek origin, is declined:

Nom. — Prīnos.
Gen. — Prīni.
Acc. — Prīnon.
Abl. — Prīno, etc.

The remaining nouns of the second declension all end in *us* (with four exceptions, masculine), and are declined like the following example:

Nom. — Junīperus.
Gen. — Junīperi.
Acc. — Junīperum.
Abl. — Junīpero, etc.

Indeed, all prescription nouns ending in *us* are of the second declension, save seven:

Nom.	*Gen.*	
Rhūs,	Rhōis,	3d fem.
Cŏrnus,	Cŏrnus,	4th fem.
Quĕrcus,	Quĕrcus,	
Frūctus,	Frūctus,	4th masc.
Haūstus,	Haūstus,	
Pōtus,	Pōtus,	
Spīritus,	Spīritus,	

The four exceptions to the masculine gender mentioned are:

Junīperus,
Prūnus,
Sambūcus,
Ŭlmus,
} all fem.

With these—to be committed to memory—the second declension ends, so far as it concerns the prescription-writer.

While touching upon the fourth declension it may be well to complete the study of it, there being but six nouns, ending in *us*, of this declension (Rhūs is of the third). They are, as already enumerated:

Cŏrnus,
Quĕrcus,
Frūctus,
Haūstus,
Pōtus,
Spīritus,

and are thus declined:

Singular.

Nom. — Spīritus.
Gen. — Spīritus.
Acc. — Spīritum.
Abl. — Spīritu.

Plural.

Nom. — Spīritus.
Gen. — Spīritûm.
Acc. — Spīritus.
Abl. — Spirītibus.

We now come to the third declension, to which belong all nouns not included in the foregoing first, second, and fourth, the fifth Latin declension, like the dative and vocative cases, not being used in prescriptions. All nouns, with seventeen exceptions, having terminations other than *a* (except four), *us*, *um*, and *on*, are of the third declension.

Here the changes from nominative to genitive and other cases are quite variable, and may be best remembered by arranging the nouns in groups according to their nominative endings, with examples of their several declensions.

GROUP I.—Thirty-three nouns ending in *as* make the genitive in *atis*. All are masculine save Asclēpias (Gen. Asclepīadis), which is feminine, and all are names of salts. Example:

Singular.

Nom. — Nītras.
Gen. — Nitrātis.
Acc. — Nitrātem.
Abl. — Nitrāte, etc.

GROUP II.—

Nouns ending in *is:*

(*a*) Genitive unchanged; all feminine.
Ex. Nom. Cănnabis; Gen. Cănnabis.

(*b*) Genitive changing into *ītis*, all masculine.
Ex. Nom. Ărsenis; Gen. Arsenītis.

(*c*) Genitive changing into *ĭdis*, all feminine.
Ex. Nom. Hamamēlis; Gen. Hamamēlidis.

(*d*) Genitive changing into *ĕris*, one only, masculine.
Ex. Nom. Pūlvis; Gen. Pūlveris.

GROUP III.—

Nouns ending in *o*, all feminine except Cārbo, Pēpo, and Sāpo, which are masculine:

(*a*) Genitive ending in *ōnis*.
Ex. Nom. Lōtio; Gen. Lotiōnis.

(*b*) Genitive ending in *ĭnis*.
Ex. Nom. Mucilāgo; Gen. Mucilāginis.

GROUP IV.—

Nouns ending in *x*, masculine or feminine:

(*a*) Genitive ending in *cis*.

Ex. Nom. Bōrax; Gen. Bōracis.

(*b*) Genitive ending in *cis*, and the last vowel of the nominative (*e*) changed to *i*.

Ex. Nom. Rūm*e*x; Gen. Rūm*i*cis.

GROUP V.—

Nouns ending in *r*, masculine or neuter:

Genitive simply adds *is*.

Ex. Nom. Līquor; Gen. Liquōris.

GROUP VI.—

Nouns ending in *a*, all neuter:

Genitive ends in *ātis*.

Ex. Nom. Enēma; Gen. Enēmatis.

GROUP VII.—

Nouns ending in *s*, masculine or feminine:

Genitive ends in *is*.

Ex. Nom. Ădeps; Gen. Ădipis.

GROUP VIII.—

Nouns ending in *l*, all neuter:

(*a*) Genitive simply adds *is*.

Ex. Nom. Chlōral; Gen. Chlorālis.

(*b*) Genitive doubles *l* and adds *is*.

Ex. Nom. Mĕl; Gen. Mĕllis.

GROUP IX.—

Nouns ending in *n*, all neuter:

(*a*) Genitive ending in *ōnis* (nominative in *ōn*).

Ex. Nom. Līmon; Gen. Limōnis.

(*b*) Genitive ending in *inis* (nominative in *en*).

Ex. Nom. Sēmen; Gen. Sēminis.

[Erīgeron has the genitive Erigerōntis.]

GROUP X.—

One noun ending in *c*, neuter:

Genitive simply adds *is*.

Ex. Nom. Lāc; Gen. Lāctis.

…sion, there are a number of indeclinable nouns, such …f various endings and derivations.

ADJECTIVES.

These are many, and, as has been said, their agreement in gender, case, and number with the nouns they qualify is of paramount importance in correct prescription-writing. They are declined like nouns of different declensions, having the same cases and numbers, and may be divided into two classes.

CLASS I. includes all but fourteen of the adjectives used in prescriptions. The nominative has three distinct endings: *us*, masculine, declined like the second declension of nouns; *a*, feminine, declined like the first declension; and *um*, neuter, declined like the second declension. Example:

Singular.

	(2d decl.) *Masc.*	(1st decl.) *Fem.*	(2d decl.) *Neut.*
Nom.	Flūidus,	Flūida,	Flūidum.
Gen.	Flūidi,	Flūidæ,	Flūidi.
Acc.	Flūidum,	Flūidam,	Flūidum.
Abl.	Flūido,	Flūidâ,	Flūido.

Plural.

Nom.	Flūidi,	Flūidæ,	Flūida.
Gen.	Fluidōrum,	Fluidārum,	Fluidōrum.
Acc.	Flūidos,	Flūidas,	Flūida.
Abl.	Flūidis,	Flūidis,	Flūidis.

CLASS II. includes the remaining fourteen adjectives in use. These, with few exceptions, have two, instead of three endings: one in *is* for both masculine and feminine genders, and another in *e* for the neuter. Adjectives of this class are declined like nouns of the third declension. Example:

Singular.

	Masc. and Fem.	*Neut.*
Nom.	Dūlcis,	Dūlce.
Gen.	Dūlcis,	Dūlcis.
Acc.	Dūlcem,	Dūlce.
Abl.	Dūlci,	Dūlci.

(The form Dūlce is sometimes wrongly used for the ablative.)

Plural.

Nom.	Dūlces,	Dūlcia.
Gen.	Dūlcium,	Dūlcium.
Acc.	Dūlces,	Dūlcia.
Abl.	Dūlcibus,	Dūlcibus.

The exceptions in nominative endings are—

Singular.

		Masc. and Fem.	*Neut.*
(1)	Nom.	Effervēscens,	Effervēscens.
	Gen.	Effervescēntis,	Effervescēntis.
	Acc.	Effervescēntem,	Effervēscens.
	Abl.	Effervescēnte, or -i,	Effervescēnte, or i.

Plural.

Nom.	Effervescēntes,	Effervescēntia.
Gen.	Effervescēntium,	Effervescēntium.
Acc.	Effervescēntes,	Effervescēntia.
Abl.	Effervescēntibus,	Effervescēntibus.

Singular.

(2)	Nom.	Trīcolor,	Trīcolor.
	Gen.	Tricolōris,	Tricolōris.
	Acc.	Tricolōrem,	Trīcolor.
	Abl.	Tricolōre, or -i,	Tricolōre, or -i.

Plural.

Nom.	Tricolōres,	Tricolōra.
Gen.	Tricolōrum,	Tricolōrum.
Acc.	Tricolōres,	Tricolōra.
Abl.	Tricolōribus,	Tricolōribus.

Singular.

		Masc. and Fem.	*Neut.*
(3)	Nom.	Fōrtior,	Fōrtius.
	Gen.	Fortiōris,	Fortiōris.
	Acc.	Fortiōrem,	Fōrtius.
	Abl.	Fortiōre, or -i,	Fortiōre, or -i.

Plural.

Nom.	Fortiōres,	Fortiōra.
Gen.	Fortiōrum,	Fortiōrum.
Acc.	Fortiōres,	Fortiōra.
Abl.	Fortiōribus,	Fortiōribus.

Numerals as far as *quatuor* are declined like adjectives of three terminations:

Singular.

		Masc.	*Fem.*	*Neut.*
(1)	Nom.	Ŭnus,	Ŭna,	Ŭnum.
	Gen.	Unīus,	Unīus,	Unīus.
	Acc.	Ŭnum,	Ŭnam,	Ŭnum.
	Abl.	Ŭno,	Ŭna,	Ŭno.

Plural.

(2)	Nom.	Dūo,	Dūæ,	Dūo.
	Gen.	Duōrum,	Duārum,	Duōrum.
	Acc.	Dūos,	Dūas,	Dūo.
	Abl.	Duōbus,	Duābus,	Duōbus.

Plural.

		Masc.	*Fem.*	*Neut.*
(3)	Nom.	Trēs,	Trēs,	Trīa.
	Gen.	Trium,	Trium,	Trium.
	Acc.	Trēs,	Trēs,	Trīa.
	Abl.	Tribus,	Tribus,	Tribus.

[The *ordinal* numbers, prīmus, secŭndus, tĕrtius, etc., are not used in prescription-writing.]

Conjunctions—Adverbs.

Conjunctions are rare, except *ĕt*, and. Adverbs are very seldom employed.

Prepositions.

Three prepositions govern the *accusative* case: *ăd*, to, up to; *in*, into; and *sūpra*, upon. Others are rarely used.

Two prepositions, oftenest used, govern the *ablative* case: *cŭm*, with, and *prō*, for.

Words and Phrases.

[In the following list accepted usage rather than rigid adherence to Latin quantity has in a few instances appeared advisable. One would hardly insist upon *sĕmel, tĕre, bĕne,* (*semmel, terry, benny*) in place of the customary long vowel sounds, though the former are obviously in accordance with Latin prosody.]

Ăd lĭbitum, at pleasure.
Ăd saturāndum, to saturation.
Āna, āā, of each.
Bēne, well,
Bis, twice.
Bis indies, twice a day.
Cĭbus, food.
Cochleāre mēdium, a dessertspoon(ful).
Cochleāre māgnum, a tablespoon(ful).
Cochleāre pārvum, a teaspoon(ful).
Collutōrium, a mouth-wash.
Dein, afterward.
Dimidius, half.
Dōsus, a dose.
Ĕt, and.
Extĕnde sūpra, spread upon.
Gradātim, gradually.
Gūtta, a drop.
Guttātim, drop by drop.
Hōra, an hour.
Ĭn dies, daily.
Lagēna, a bottle.
Lībra, a pound.
Līnteum, lint.
Māne, in the morning.
Māne prīmo, early in the morning.
Mica pānis, a breadcrumb.
Nōn, not.
Nōcte, at night.
Nūmerus, a number.
Nūmero, in number.
Octārius, a pint.
Pārtes æquāles, in equal parts.
Prō rē nātâ, as required.
Quāntum sufficiat, q. s., as much as is necessary.
Quāqua hōrâ, every hour.
Saturātus, saturated.

Scātula, a box.
Sēmel, once.
Semissis, ss., a half.
Semidrāchma, half a drachm.
Sīmul, together.
Sine, without.
Stātim, immediately.
Tāles, such.
Tāles dōses, such doses.
Tĕre sīmul, rub together.
Tĕr in dĭe, three times a day.

These complete the list of Latin parts of speech, conjugations, declensions, etc., with which the prescription-writer is likely to be concerned.

There are niceties of Latin construction which, to one acquainted with that idiom, will readily occur in scanning the order of words in certain medicinal compounds. Having the sanction of professional usage, the departure from the classic arrangement is of slight importance, and it is certainly in accordance with the clearer, more direct English form. Instance the construction in what are known as "Galenical Preparations" (an objectionable adjective, by the way, being at variance with the rules of etymology, since the *c* of the derivative is wanting in the parent word *Galen*). In writing these the nominative—Unguĕntum, Mistūra, Tinctūra, etc.—is placed *first*, as, Unguĕntum Zĭnci Ŏxidi, etc. Ŏleum Mŏrrhuæ is also an example, and others are not uncommon, apart from the Galenical order.

The practical difficulties in writing prescriptions correctly are largely eliminated by the almost exclusive use of the *genitive*. Yet it is necessary to understand clearly the use of the *accusative* in all cases where the medicine is prepared from the *mass* according to certain established formulæ, and moulded in certain forms, if not already prepared, as in the condition of pills, troches, etc., which are the immediate *object* of the imperative *rĕcipe*, and cannot be placed in the genitive.

Example:

℞. *Pĭlulas* (not Pilulārum) Fĕrri Iōdidi (a *number*).

Where the mass is mentioned or implied in the prescription, the general rule of the *genitive* is followed, as: ℞. Unguĕnti Bella-

dōnnæ (a portion); and where the terms fīat, fīant are expressed, the *nominative* is naturally used, as, for example,

℞. Māssæ hydrārgyri, gr xxx;
Fīant pīlulæ No. x.
Sig. Take one at bed-time.

Here *pīlulæ* is the subject of the Latin irregular verb signifying "to be made," no case save the nominative being admissible.

It has been presumed in the foregoing pages that all prescriptions are to be written in full—a practice which, could it meet with universal acceptance, would not infrequently be of vital importance alike to patient and practitioner. Custom, however—and in certain cases advantageously—has authorized the extensive use of *abbreviations*, although the dangers of carelessness or ignorance in their employment will be apparent if we consider that, for example, *Ammon.* may mean either Ammonia or Ammoniacum; *Chlor.*, Chlorum, Chloral, Chloroformum, Chloras, or Chloridum; *Hyd. Chlor.*, Hydrate of Chloral or Hydrargyri Chloridum Corrosivum or Mite; *Sulph.*, Sulphur, Sulphas, Sulphidum, or Sulphis; *Zinc. Phos.*, Zinci Phosphas or Zinci Phosphidum.

These are but few of the many instances of ambiguity occasioned by inadvertence or want of familiarity with the full Latin form, or at least its recognized and unmistakable abbreviation.

In conclusion, let the writer of prescriptions be warned against too great haste and a chirography which none but its author can decipher—a deficiency for which he alone is responsible, though the onus may fall upon the luckless druggist or his bewildered clerk.

With regard to form, it has been our object to show that there is really little difficulty in writing good prescription Latin, and where the slightest chance of error exists the ampler expression, as we have strongly urged, should be used. A clear, business-like method, deliberately chosen and consistently pursued, will render this important item of the physician's labor simple, agreeable, and efficient.

It is necessary not only that the directions to the patient should be written in perfectly legible English and in full, but that they should contain the exact dose, time for, and method of taking, and, in short, every detail which it may be advisable for the patient and nurse to know, clearly and intelligibly expressed. A physician is

seldom justified in writing merely "As directed," the full directions being the only clue to the safety of the medicine. Moreover, verbal instructions to the patient or attendant may be partially or even wholly forgotten, or confounded with directions relating to other matters connected with the case, and thus the welfare of the patient be endangered.

All preparations intended for external or local application or for injections should be marked accordingly, "For External Use," etc.; and if the agent be a poisonous mixture, a "Not-to-be-taken" label should be attached to the bottle. If a mixture is ordered containing an insoluble substance, a "Shake-well" label should be used.

Should it be necessary to prescribe an extraordinary dose of some powerful drug, the name of the remedy should be underscored or attention called to it by a ×, referring to the bottom of the prescription, where should be written: "Large dose intended," or "Dose of above correct," or something to indicate to the pharmacist that the writer is fully aware of the unusual amount, and thus save delay in consulting with the physician—which a careful and competent druggist would otherwise do. Should it, in the opinion of the physician, be undesirable to repeat the prescription, he should write at the bottom, "Do not repeat," or the customary Latin, "Ne repetatur."

Every prescriber should be supplied with suitable prescription-blanks arranged in the form of pads conveniently carried in the pocket, a suitable size being four by five inches. The paper should be of linen, of good quality; otherwise it is liable to become detached from the druggist's files and lost. A convenient form of pad is composed of prescription blanks with interleaves and copying paper, so that the physician may always retain an exact record of the remedies ordered for his patient.

It is certainly advisable for the physician to write his prescriptions invariably in ink, since pencil is easily erased, and a prescription thus perishable would be of little use in medico-legal emergencies. Besides, an unscrupulous druggist who had been careless in compounding the remedy might easily change the pencil instructions to conform to his mistake. Finally, the pencil-writing is always liable to be erased or partially obliterated when carried for some time or subjected to frequent handling.

The prescription-blank should have printed neatly upon one margin or the back the physician's residence and office, together with hours for consultation, and telephone number if he has one.

This advertises the physician to some extent in a legitimate way, besides enabling the patient or druggist to communicate with him readily if necessary.

It is a matter of personal taste whether the druggist's name should appear upon the blank. Considerations of courtesy and the possible event of loss or of legal contingencies may weigh with some practitioners, though others are of the opinion that it is undesirable to print anything on the blank save the physician's name, office, hours, and telephone number.

The prescription should always be signed by the writer in full, that professional responsibility and identity may be assured, the academic "M. D." being preferable as a title to "Dr.," which is applicable to various professions—often of questionable repute and authenticity.

In concluding these practical hints, the author cannot too strongly impress upon the student the importance of always writing as clear, legible, complete, and classical a prescription as possible. In a new community the reputation of the recent graduate is often dependent upon the character of the prescription he writes. The druggist invariably scans his instructions from the new doctor critically, and the laity and the profession will soon learn the young aspirant's proficiency or ignorance by his public committal in a prescription. No matter how able a diagnostician, pathologist, or bacteriologist he may be, if his first effort in *prescription-writing* be illegible, poor Latin or for a hopelessly incompatible mixture, the druggist will label, classify, and measure him with the keenness of professional insight; the judgment will go forth quietly; and years of successful practice may not serve to eradicate that first unfavorable impression.

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